Models of Child Health Appraised

(A Study of Primary Healthcare in 30 European countries)

WP 7: Report on differences in outcomes and performance by SES, family type and migrants of different primary care models for children

Commission Deliverable D12 (D7.2)

Version 1.1 December 2017

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Report on differences in outcomes and performance by SES, family type and migrants of different primary care models for children

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Origin

Work Package 7: Ensuring equity for all children in all models

Status

Completed (V 1.1)

Distribution

European Commission

MOCHA Consortium

General Public

Version Control	
V 1.0	Completed November 2017
V 1.1	December 2017. Minor typos corrected.

Summary

All European Union (EU) Member States have agreed to address inequalities in health outcomes. To do this requires policies that include actions to reduce the gradient in health across the whole of society, and actions that specifically target vulnerable groups. Primary care, defined broadly as the first point of call for any individual in need of preventive or curative health advice and action, has an important role in this action.

"Inequity" in health is the presence of "systematic and potentially remediable differences among population groups defined socially, economically, or geographically, and is used in this sense throughout this report. Inequity in access to health care can be described as horizontal or vertical. Horizontal inequity in access to health care services indicates that people with the same needs do not have access to the same health care resources. Vertical inequity exists when people with greater health care needs are not provided with resources adequate for their needs. This report investigates both types of inequity and its relationship to the different models of primary health care for children in the EU member states, Iceland and Norway.

A large body of research shows that inequities in health are present in a wide range of health outcomes and indicators throughout the life course, beginning during the intrauterine period. Although inequities in health primarily are caused by social determinants, the health services have an important role in buffering the effects of adverse social determinants. Early childhood in particular, defined as the period between prenatal development to 8 years of age, is increasingly recognized as the most crucial period during the life course for future health. At this time of life, the foundations are laid for an individual's physical and mental capacities, which influence their subsequent growth, health, and development throughout the life course. Consequently, the quality of primary care health services is particularly important in early childhood when the negative effects of poor health on the developing body and mind can be minimised.

This report aims to evaluate equity in national models of primary care in the MOCHA countries, by using systematic reviews of the literature as well as a pioneering study of quality indicators based on administrative data. There were no indications that inequity patterns in access to care were primarily determined by the general wealth of countries or the distribution of wealth within a country, thus giving considerable room for each individual health care organisation to act as a determinant of inequity. The primary health care organisations in Austria, Belgium, France and Germany all allow

primary care physicians a relatively large amount of freedom to choose where to set up their practice within the primary care organisation, and there is comparatively limited influence of the national or regional government, the so called *professional non-hierarchical* model. The studies reported in the literature reviews indicate that this type of health care organisation is associated with considerable regional differences in access to health care. For Austria and Germany, there were also indications of considerable socio-economic differences in uptake of preventive health services and for Germany also in access to care.

Health care reform is currently on-going in many European countries with universal access to care in a National Health Service, such as the United Kingdom, Spain and Sweden. These reforms have some common features including increased possibilities to establish new private outpatient practices reimbursed by public funds at locations chosen by the health care professionals themselves, and thus move these primary care models closer to the *professional non-hierarchical model*. The effects of these reforms on inequity patterns in children thus need to be monitored and evaluated.

A child specific aspect of primary care models in Europe is the presence of paediatricians as the main primary care physician for children in many countries, sometimes mixed with family physicians/general practitioners. The type of physician serving children was not found to determine equity in access to care in the reviewed literature. The organisation of preventive health care is another child specific aspect of national models of primary care. Six MOCHA countries; Belgium, Finland, Iceland, the Netherlands, Norway and Sweden, have a special organisation for preventive health services for the youngest children, “well-baby clinics”. These are built around child or public health nurses, with other child health professionals, such as physicians and psychologists acting as consultants in a child health team. In comparison, other countries have preventive health services that are more integrated into the regular primary care organisation, and often have physicians in a more prominent role. According to the literature reviews and the data collected, the six countries with well-baby clinics all have generally equitable uptake of vaccination and use of other preventive services for pre-school children, while this is not the case many systems without well baby clinics. Considering this variation in inequity by organisation of preventive health services, a broader perspective might be fruitful in future developments in preventive health services, where changes in the overarching primary care model might be a more effective way to improve equity in uptake of prevention than to implement small scale interventions within the existing primary care model.

Gender patterns were rarely the main focus of the studies reviewed, and were quite often not reported at all, particularly for the younger children. There were indications of important differences in use of

health care between genders in adolescents, suggesting that this is an important age group for future studies of gender differences in access to care. Studies that described quality indicators of primary care in relation to family type were even more rare, and thus made it impossible to draw any conclusions about this aspect of inequity.

The diverse criteria used to categorize migrant populations and ethnic minorities in the different data sources in this study greatly limited the possibility for meaningful comparison between countries and primary care models. However, some implications of policy were reported. A previous MOCHA report identified Germany as a country where policy limits entitlements for primary care for undocumented children, and accordingly a much higher use of emergency care were found in these children in Germany. Two studies of vaccination rates in Denmark showed lower rates of vaccination for pre-school as well as school-aged children in refugee families, indicating that the provision of health care for newly settled refugees in a parallel health care system, as in Denmark, can be a problematic policy.

This report pioneered the use of administrative data in cross-country comparisons of equity in quality in primary care for children. We looked at vaccinations, age at operation of cryptorchidism, two ambulatory care sensitive conditions and age at diagnosis of autism. Uptake of vaccinations was found to be a robust and accessible indicator of equity in preventive health services on the national level. Age at operation for cryptorchidism was also a quite robust and accessible indicator, but needs more evaluation regarding the interpretation of operations beyond preschool age. The interpretation of the cross-country patterns of the ambulatory care sensitive conditions hospital admissions for asthma and gastroenteritis were more problematic because of the interference of structural aspects of hospital care for these indicators that leads to great variation in incidence rates. Both these indicators showed considerable differences between social groups, however, suggesting that neither country studied had a sufficient provision of health care resources to socially disadvantaged groups, in other words, vertical inequity.

The material presented in this report is limited when it comes to the situation in the new member states in Eastern Europe. Vaccination rates in this part of Europe are traditionally high, suggesting that inequities are not present, or are not easily detectable using this indicator. The low vaccination rates among the Roma population, however, found in several studies suggest that there is inequity of provision of vaccinations also in this part of Europe. The considerable variation in vaccination rates for Roma between different countries in Eastern Europe indicates that there are important experiences of facilitating access to care for Roma children that need to be documented and shared.

This report was greatly hampered by a dearth of studies and health statistics that can be used to evaluate equity aspects of primary care for children in Europe. Thus, more evaluative research and monitoring is needed to inform primary care models for children with regards to equity. This lack of data perhaps constitutes an element of inequity in itself – children as a population group are not monitored in a manner that is effective in improving health on an equitable scale.

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1. Introduction

This report has been produced within the EU-funded Models of Child Health Appraised (MOCHA) project, which appraises primary health care for children in the 28 EU countries, Iceland and Norway. Primary care is defined broadly in the MOCHA project as the first point of call for any individual in need of preventive or curative health advice and action. Work Package 7 has the responsibility of addressing inequity aspects of these national primary care models. In two previous reports we have described the health care situation for two particularly vulnerable groups of children in Europe; migrant children[1] and children in residential and foster care [2]. All MOCHA deliverables can be found at the MOCHA website www.childhealthservicemodels.eu/publications/deliverables/. In this report we will look at broader inequity issues in health care for children in Europe with regards to gender, socio-economic, ethnic and regional disparities.

EU Member States have agreed to address inequalities in health outcomes [3]. This requires policies which include both actions to address the gradient in health across the whole of society as well as actions which are specifically targeted to vulnerable groups. There is a need to give particular attention to families and children in poverty, disadvantaged migrant and ethnic minority groups, people with disabilities, and the elderly people. For some groups the access to adequate health care can be described as one which involves their fundamental rights [4].

The UN Convention on the Rights of the Child (UNCRC) has been ratified by all members of the United Nations (193 countries), except for the United States. States party to the UNCRC must ensure that its provisions and principles are fully reflected and given legal effect in relevant domestic legislation. One of the general principles of the Convention is non-discrimination which is outlined in the second paragraph, all children have the same rights irrespective of social or legal status. Thus, an equitable health care is not negotiable for children, it is something that is a duty for countries that have signed this convention.

Inequality or inequity ?

Health differences between economically privileged and underprivileged population groups were initially labelled as ”inequalities” [5]. Since the mid 80’s, however, the term ”inequity” has been used for the presence of ”systematic and potentially remediable differences among population groups defined socially, economically, or geographically” [6], and will be used in this sense throughout this report. Equity in Health implies that ideally everyone could attain their full health potential and that no one should be disadvantaged from achieving this potential because of their social position or other socially determined circumstance [7].

Inequity in access to health care can be horizontal or vertical. Horizontal inequity in access to health care services indicates that people with the same needs do not have access to the same health care resources. Vertical inequity exists when people with greater health care needs are not provided with resources adequate for their need [8].

The importance of early childhood

The period of early childhood, defined as the period between prenatal development to 8 y of age, is increasingly recognized as the most crucial period during the life course and the period that is tje most highly sensitive to external influences [9]. During early childhood, the foundations are laid for every individual's physical and mental capacities, that influence their subsequent growth, health, and development throughout the life course. In certain aspects of child health and development, the potential adverse effects of social and biological influences, such as suboptimal infant brain growth, are likely to be irreversible [10]. Hence, intervening to improve early childhood health and developmental outcomes is increasingly being suggested as a priority, as potential interventions are expected to have a stronger impact on an individual's life course health and development while also achieving higher returns than later interventions [11]. In recognition of the importance of early childhood, the World Health Organisation (WHO) Commission on Social Determinants of Health in their final report *Closing the Gap in a Generation* [12] suggested that "equity from the start" should be an essential component of any attempt to improve health outcomes overall and, in particular, to address health inequalities. In consequence, the quality of health services is particularly important in early childhood, so that the negative effects of poor health on the developing body and mind can be minimised.

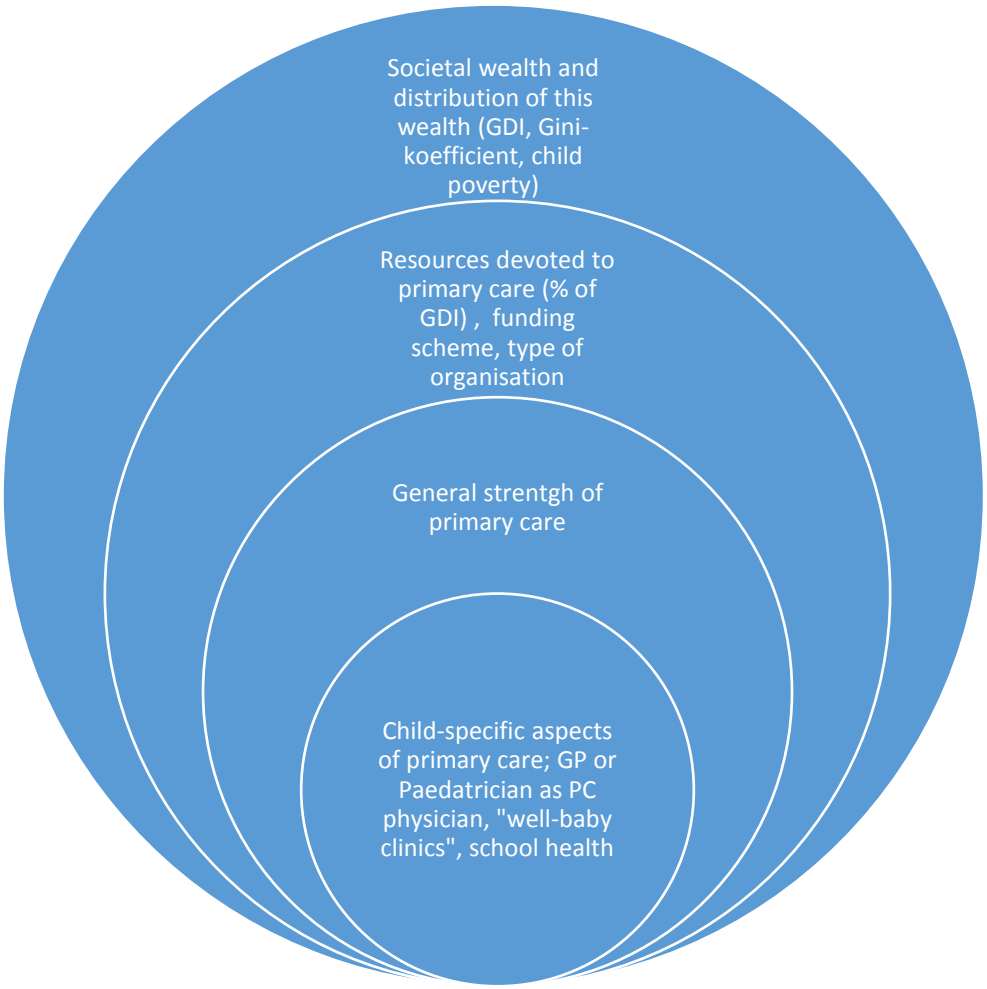
Inequity in primary care models for adults in Europe.

Stirbu et al [13] analyzed data on the use of general practitioners (GP) and specialist services from national health surveys of Belgium, Estonia, France, Germany, Hungary, Ireland, Latvia, the Netherlands and Norway. Their survey only included adult primary care users, but they found that individuals with a lower educational level used GP services equally often in most countries compared to individuals with a higher level of education. Belgium and Germany were exemptions, where people with low education accessed primary care less often. People with a higher education used specialist care services significantly more often in all countries, except in the Netherlands.

A theoretical framework of factors that determine equity in primary care models for children

There is a considerable complexity and diversity in factors that may potentially affect inequities within primary care for children in Europe. Figure 1 describes how primary care is built in a societal structure with different levels of material resources that can be divided within the countries in more or less equal ways, and to give more or less priority to welfare policies that protect children within this structure. All these macro factors will affect a child and family's health care needs, and also to a certain extent their help-seeking patterns. The choice of each society of the proportion of resources devoted to primary and preventive care as part of the greater health care system, often in competition with high tech medicine in hospitals; can directly affect equity of access and of care. In addition to this, the implementation of different organisational models with these resources affects patterns of access to care. Finally, there are also important child-specific aspects of primary care that have relevance to equity, such as the lead physicians for children in primary care, the role of school health and the organisation of preventive care for preschool children.

Figure 1. A theoretical model of determinants of equity in primary care for children.



Societal wealth and its distribution

The wealth of a country can be measured by gross domestic product (GDP). There are great variations in societal wealth as measured by GDP per capita within the EU/EEA area (Table 1). The most affluent country (Luxembourg) has a GDP per capita which is 14 times higher than the least affluent (Bulgaria). There is considerable evidence, however, that the distribution of wealth within a country, the differences between the richest and the poorest, often measured by the Gini-coefficient, is even more important than the total wealth of countries for population health in high income countries. Picket and Wilkinson has demonstrated that a more equal distribution of resources within a society is associated with a more favourable child well-being [14] as well as lower adult mortality [15].

A large body of research shows that inequities in health related to social position in the population are present in a wide range of health outcomes and indicators throughout the life course, starting already during the intrauterine period. Neighborhood deprivation, parental lower parental income/wealth, child poverty, income inequality, educational attainment, and occupational social class, higher parental job strain, parental unemployment, lack of housing tenure, and household material deprivation have been identified as the key social factors that explains these inequities in child health and developmental outcomes. [16]. Children in lower social strata, however, have not only more illnesses, but also more severe illnesses [8]. This indicates that health services have an important role to buffer the effects of the social determinants of health by providing effective treatment that can improve the health and quality of life for children with chronic disorders [8]. Thus, needs for health care are greater in children in socially disadvantaged families. Unfortunately, underprivileged groups, despite their higher needs, are often shown to have less access to care than the more privileged, given rise to the concept of “the inverse care law” [5,17].

Table 1 demonstrates that there are countries with a high degree of equality among the European countries with relatively lower levels of GDI per capita, such as Slovenia, Czech Republic and Slovakia, as well as countries with high degrees of inequality such as Bulgaria, Romania and Lithuania. There is a similar large variation in distribution of wealth among countries with a higher GDP per capita, where United Kingdom stands out as a country with a particularly unequal distribution of income among the more affluent countries. As Table 1 shows, national levels of relative child poverty tend to follow the general distribution of wealth in a society. UK again stands out, as a country with a comparatively modest rates of child poverty, despite a high degree of inequality with regards to distribution of wealth.

Table 1. Economic indicators of the 30 European countries included in MOCHA.

Country	GDP per capita in USD, World Bank 2016[1]	Gini-koefficient, OECD/Eurostat 2015[2]	Child poverty, % Eurostat 2015[4]
Austria	44,177	0.27	18.3
Belgium	41,283	0.27	21.1
Bulgaria	7,368	0.37[3]	41.3
Croatia	12,090	0.30[3]	29.1
Cyprus	23,351	0.34[3]	28.9
Czech Republic	18,286	0.26	14.0
Denmark	53,743	0.26	17.7
Estonia	17,632	0.35	24.2
Finland	43,169	0.26	16.8
France	38,127	0.30	17.7
Germany	41,902	0.29	20.0
Greece	17,900	0.34	35.7
Hungary	12,778	0.29	28.2
Iceland	59,629	0.25	13.0
Ireland	62,562	0.30	No data
Italy	30,507	0.33	28.7
Latvia	14,060	0.35	30.9
Lithuania	14,890	0.38	29.3
Luxembourg	103,198	0.28	18.5
Malta	25,214	0.28[3]	22.4
Netherlands	45,282	0.30	16.4
Norway	70,391	0.26	15.0
Poland	12,305	0.30	23.4
Portugal	20,830	0.34	26.6
Romania	9,465	0.37	37.4
Slovak Rep.	16,498	0.25	18.4
Slovenia	21,320	0.25	19.2
Spain	26,608	0.34	28.6
Sweden	51,164	0.27	16.0
UK	40,095	0.36	23.0

[1] http://data.worldbank.org/indicator/NY.GDP.PCAP.CD

[2] http://www.oecd.org/social/income-distribution-database.htm

[3] Eurostat 2015 http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_di12

[4] http://ec.europa.eu/eurostat/statistics-explained/index.php/Children_at_risk_of_poverty_or_social_exclusion

Primary care models in Europe

There are both similarities and diversity between the primary care models in Europe, as was described in a previous MOCHA report [18]. A primary care physician is the focal point of primary care provision in most countries, including being the main point of entry to the health care system; taking a medical advocacy role for individual patients; and acting as the coordinator of the care. There is also a consensus around universal access to to primary care services for everyone and to keep co-payments low for primary care use [19].

Funding schemes of primary care in Europe.

There is a considerable variety of financing schemes for primary care in Europe [18]. Tax-funded care is present in Scandinavia, the UK, Spain and Italy while other countries rely entirely on insurance funding or have a mixture of tax funded and insurance funded primary care, this is shown in Table 2.

Based on three aspects of health care organisations: financing, service provision, and regulation, the Organisation for Economic Cooperation and Development (OECD) has suggested three categories of health care organisations: the National Health Service (NHS) the social health insurance model (SHI), and the private health insurance model (PHI) [20]. The NHS model features universal coverage, funding from general tax revenue, and public ownership of the health infrastructure. Böhm[20] has further categorised the NHS models into NHS proper and the National Health Insurance (NHI) model, where services are contracted out to for-profit providers, but funded by the state. The SHI model combines universal coverage with funding coming mainly from contributions and public or private delivery. Finally, in the PHI model coverage is based on private insurance only, which is also the major funding source. Further discussion and analysis of types of funding system will be presented in a forthcoming deliverable from MOCHA (“Short report on financial systems and their impact on outcomes”) to be published in March 2018.

Geographically north-western Europe (Scandinavia and the United Kingdom) is oriented towards an NHS Model, whereas western-central Europe, under the historical and cultural influence of France and Germany, tends to be based on the SHI model [19]. No EU/EEA country has adopted the PHI model, which is the model found in the United States [20].

Organisation and freedom of professionals in primary care

As outlined in Table 2, Bourgueil et al [21] has suggested a classification of three categories to clarify the main differences between the primary health care organisations in Europe and the freedom of primary care professionals within them. In the *public hierarchical normative model* primary care has a central

place in the health care system, and is run by the state rather than by professionals. These systems are usually governed by decentralized authorities, for example regions, and consist of multidisciplinary teams with a publically employed staff of physicians and paramedics. Examples are Finland, Lithuania, Portugal, Spain and Sweden. In the *professional hierarchical gatekeeper* model independent physicians are the cornerstone and are themselves accountable for the management of resources used for health care. This model includes Estonia, Poland, the Netherlands, Denmark, Slovenia and the United Kingdom. In the *free professional non-hierarchical* model health care professionals provide primary care without strong regulation from the state or health insurance funds. The model emphasises patient and professional freedom; there is an absence of a patient list system and no gatekeeping function, and professionals are self-employed. Primary care professionals work in competition with each other rather than in cooperation, and in this system general practice is not valued highly in terms of professional status, and many physicians working in primary care are also specialists in another branch of medicine than family medicine.

As shown in Table 2, the *professional non-hierarchical* model as defined by [21] above, often co-exists with SHI funding schemes. Austria, Belgium, France and Germany are examples of this.

Table 2. Primary care characteristics in the 30 MOCHA countries. (NHS=National Health Services, NHI=National Health Insurance, SHI=Social Health Insurance)

Country	Outpatient curative expenditures % of total health expenditures OECD 2015	Type of Healthcare systems, simplified version of Böhm et al [20]	Type of Organisation of Primary Care, Bourgueil et al [21]	Primary care strength, Kringos et al [22]
Austria	25.0	SHI	Non-Hierarch Prof	Weak
Belgium	19.2	SHI	Non-Hierarch Prof	**Strong**
Bulgaria	No data	SHI	Hierarch Normative	Weak
Croatia	No data	SHI	Hierarch Normative	No data
Cyprus	No data	NHS and SHI.	Non-Hierarch Prof	Weak
Czech Republic	27.8	SHI	Hierarch Normative	Medium
Denmark	28.8	NHS	Hierarch Prof	**Strong**
Estonia	29.9	SHI	Hierarch Normative	**Strong**
Finland	34.0	NHS	Hierarch Normative	**Strong**
France	18.9	SHI	Non-Hierarch Prof	Medium

Table 2 cont'd

Country	Outpatient curative expenditures % OECD 2015	Type of Healthcare systems, simplified version of Böhm et al [20]	Type of Organisation of Primary Care, Bourgueil et al [21]	Primary care strength, Kringos et al [22]
Germany	22.3	SHI	Non-Hierarch Prof	Medium
Greece	22.0	NHS and SHI	Non-Hierarch Prof	Weak
Hungary	20.9	SHI	Hierarch Normative	Weak
Iceland	27.9	NHS	Hierarch Normative	Weak
Ireland	19.2	NHI Tax funded state health system with extra health insurance funding. Free GP care for children whose families do not meet an income threshold or children with certain long term conditions.	Hierarch Prof	Weak
Italy	22.2	NHI	Non-Hierarch Prof	Medium
Latvia	20.7	NHS	Hierarch Normative	Medium
Lithuania	No data	NHI	Hierarch Normative	**Strong**
Luxembourg	25.0	SHI	Hierarch Prof	Weak
Malta	No data	NHS and SHI	Hierarch Normative	Weak
Netherlands	25.2	SHI	Hierarch Normative	**Strong**
Norway	21.0	NHI	Hierarch Normative	Medium
Poland	23.8	SHI	Hierarch Normative	Medium
Portugal	38.9	Three systems; NHS (50%), insurance funded and private.	Hierarch Prof	**Strong**
Romania	No data	NHI	Hierarch Normative	Medium
Slovak Rep.	21.7	SHI	Hierarch Normative	Weak
Slovenia	28.2	NHI	Hierarch Normative	**Strong**
Spain	30.5	NHS	Hierarch Normative	**Strong**
Sweden	29.1	NHS	Hierarch Normative	Medium
UK	25.3	NHS	Hierarch Prof	**Strong**

" Proportionate universalism"

Equity of access to effective health care coverage, comprised of utilisation, need and quality, is rarely prioritized in policy or measured in evaluations [23]. As a response to this, the concept of *proportionate universalism* has been created. This concept stresses the importance of health care services being provided in a manner consistent with needs. The European Parliament has issued a statement in support of this thinking that "Points to the need to maintain and improve universal access to healthcare systems and to affordable healthcare; Points to the importance of improving access to disease prevention, health promotion and primary and specialized healthcare services, and reducing the inequalities between different social groups, and emphasizes that these objectives could be achieved by optimizing public spending on preventive and curative healthcare and targeted programmers for vulnerable groups" [3] .

In the UK the health care resources allocated to deprived areas increased gradually from 2001 to 2011, in a policy based on proportionate universalism. As a consequence, there was a reduction in the gap in mortality between the more affluent and the more deprived areas. [24]

The vanishing east–west divide in primary care

Before the fall of communism in Eastern Europe, there was a stark "east–west" difference between the systems of primary care in Europe. In Eastern Europe there was an extremely limited role of general physicians. This difference has, however, vanished in recent years and many Eastern countries today, such as Estonia and Lithuania, have a stronger primary care system than most Western countries [19]

The strength of primary care models in Europe

There are both similarities and differences between the primary care models in Europe [18]. Models or systems of primary care have different lead practitioners, methods of funding and organisation. However, primary care systems have in common the fact that they are the main point of entry to the health care system. Primary care takes a medical advocacy role for individual patients; and acts as the coordinator of care in most countries. There is also a consensus around universal access to primary care services for all children, and the need to keep co-payments low for primary care use.

Four important dimensions of quality in primary care models are access, longitudinality/continuity, comprehensiveness, and coordination [25]. Strong healthcare systems incorporate all four important dimensions and, as a result, can generally better health care quality and better health outcomes. Studies from the USA have indicated that in systems where primary care acts as a first port of call into the healthcare system there are better preventive measures, lower hospitalizations and emergency

visits, better utilization of healthcare services, more appropriate attention, lower incidences of preventable diseases, higher adherence to pharmacologic prescriptions and lower costs compared to systems of care where children access specialised care without referral from primary care [26]. However, routine care provided by specialists to children and adolescents in the United States has demonstrated a large number of non-referred, routine and preventive care for common problems for patients already known to the physician, and many of these services could be managed in primary care settings [26].

Kringos et al [22], in 2009-10, collected national data in published and grey literature on indicators of quality of primary care in Europe, a study that was presented more extensively in a previous MOCHA report [18]. Indicators based on the four quality dimensions mentioned above (access, longitudinality/continuity, comprehensiveness, and coordination), complimented by three aspects of structure: primary care governance, economic conditions of primary care and workforce development were used to rate the strength of primary care in each country. As Table 2 shows, Belgium, Denmark, Estonia, Finland. Lithuania, the Netherlands, Portugal, Spain and the UK were judged to have the strongest primary care models of health care based on these aspects.

The resources devoted to primary care within each country vary considerably (Table 2). Countries with "strong" primary care models tend to allocate more resources to primary care, the top four countries in percentage of resources allocated (Finland, Portugal, Spain, Estonia) all have "strong" primary care models according to the Kringos categorization [22].

Child specific aspects of primary care

Many European countries, such as most of the former socialist countries in Eastern Europe, and Spain and Italy, have separate primary care systems for adults and for children. In such models of primary care for children the lead practitioner for children in primary care is usually a primary care paediatrician, in contrast to countries where a family doctor or general practitioner serves all ages in primary care. This has been outlined more in detail in a previous Mocha report [18]. In 2010, van Esso et al [27] found that twelve countries in Europe (41%) had a family doctor/ general practitioner (GP/FD) system, seven (24%) a paediatrician-based system and 10 (35%) a combined system.

Bunuel Alvarez et al [28] reviewed studies that compared quality of treatment in primary care for some common health problems in children between paediatricians and GP:s. On average, GP:s prescribed more antibiotics than paediatricians for upper respiratory tract infections of probable viral etiology, and were less likely to adhere to clinical guidelines recommendations for febrile syndrome

management and attention deficit disorder with/without hyperactivity, and showed more resolution capacity on other highly prevalent conditions in children and adolescents (such as asthma and acute otitis media). Children cared for by primary care paediatricians were also found to have higher vaccination coverage than GP:s. This finding was, however, not corroborated in a meta-analysis of vaccine studies made in a previous MOCHA report [18].

The organisation of preventive health services for children

Apart from diagnosing and treating patients with illnesses, primary care also has an important role in prevention of disease. Preventive interventions in early childhood can very often be expected to have a stronger impact on an individual's life course health and development, while also achieving higher returns than later interventions [11]. This is the reason that European societies emphasize health prevention during the first years of life, with vaccinations, screening programs, promotion of a healthy lifestyle and psychosocial support to parents.

Table 3 identifies some characteristics of preventive health care for children in the 30 MOCHA countries, based on a triangulation of information from the literature and MOCHA country agents.

Table 3. Preventive health care for children in Europe.

Country	Preventive care (all ages) expenditures in % of total health care expenditures	Charge for preventive health care	Preschool Preventive health care	Pre-school Vaccinator	Performs (post neonatal) pre-school physical screening	School age Vacc[29]
Austria[30]	2.2	No	GP/Paed office	GP/Paed	GP/Paed	GP/Paed office
Belgium[31]	1.7	Yes, if by Paed/GP. Well baby clinics are free	Well-baby clinic or private Paed/GP	Well-baby clinic or GP/Paed	Well-baby clinic or GP/Paed	School health service and GP/Paed
Bulgaria http://venice.cineca.org/documents/bulgaria_ip.pdf	No data	Mandatory vaccination are free. Recommened are paid by the family.	GP (Private)	GP	?	GP
Croatia[32]	No data	No	Pediatric primary health care team (nurse and physician)	Team nurse	Paed	GP

Table 3 cont'd

Country	Preventive care (all ages) expenditures in % of total health care expenditures	Charge for preventive health care	Preschool Preventive health care	Pre-school Vaccinator	Performs (post neonatal) pre-school physical screening	School age Vacc[29]
Cyprus	No data	Public: no, Private: yes.	Two parallell: public and private.	Public: health visitors Private: paed	Paediatricians and health visitors	Same as preschool
Czech Republic[33]	2.8	No	Paed office	Paed	Paed	Paed
Denmark[34]	2.5	No	GP office/ Public health nurse	GP	GP	GP
Estonia[35]	3.1	No	GP team	GP team	GP	School nurse
Finland[36]	4.0	No	Well-baby clinic	GP or nurse in well-baby clinic	GP at Well-baby clinic	School nurse
France[37,38]	1.9	Yes, families pay for vaccines	GP office	GP	GP	GP
Germany[39]	2.9	No	GP/Paed office	GP/Paed	GP/Paed	GP/Paed
Greece[40]	1.3	Public sector: No. Private:Yes	Paed (60%). GP.	Physician or nurse	Paed (60%). GP.	Paed (60%). GP.
Hungary	2.2	No	GP	GP?	GP	School health
Iceland	2.3	No-	Well-baby clinic inte-gratedinto PCC	GP or nurse in well-baby clinic	GP at Well-baby clinic	School nurse
Ireland[41]	2.7	No.	Primary care team (PHN and GP)	Primary care team (PHN and GP)	GP	Primary care team (PHN and GP)
Italy[42]	4.0	No	Paed	District Public Health doctors. In few regions Family Pediatricians	Paed	District Public Health doctors.
Latvia	2.5	No.	Primary care center	Primary care team (GP or nurse)	GP	Primary care team (GP or nurse)
Lithuania		No	Primary care center	PCC Nurse	GP/family paed	PCC Nurse
Luxem-bourg	2.5	No	GP/Paed	GP/Paed	GP/Paed	GP/Paed
Malta		No	Well-baby clinic	National Immunisation Service	GP	School health

Table 3 cont'd

Country	Preventive care (all ages) expenditures in % of total health care expenditures	Charge for preventive health care	Preschool Preventive health care	Pre-school Vaccinator	Performs (post neonatal) pre-school physical screening	School age Vacc[29]
Nether-lands[43]	3.6	No.	Well-baby clinic	GP, midwife or nurse in well-baby clinic	GP	Doctor or nurse at the Public Health Service
Norway	2.9	No	Well-baby clinic	GP or nurse in well-baby clinic	GP	School nurse or doctor
Poland	2.7	No	PCC, Physician or Nurse	GP/Paed in PCC	GP/Paed in PCC	PCC, Physician or Nurse
Portugal[44]	1.8	No	Primary care centers (70% Paed/ 30% GP)	PCC Nurse	PCC Physician	PCC Nurse
Romania	No data	No	GP office.	GP	GP	School health
Slovak Rep.[33]	2.2	No	Paed office	Paed	Paed	Paed
Slovenia[45]	2.7	No.	Paed PC team	Paed PC team	Paed	School health team
Spain	2.0	No	Paed PC team	Paed PC team	Paed	Paed PC team
Sweden[46]	3.1	No	Well-baby clinic	Nurse	GP	School Health nurses
UK[47]	5.2	No.	GP and health visitors	GP	GP	School health

There are important differences between countries in Europe in how they prioritise preventive health care and how they organise preventive care for children. The UK spends the most on preventive care as part of its total spending on health care (5.2%). Finland, the Netherlands, Italy, Estonia and Sweden all spend more than 3% of their health care expenditures on preventive health services.

In terms of organization of preventive health for preschool children Belgium, Finland, Iceland, Malta, Norway, the Netherlands and Sweden, all have a special organization within primary care for young children," well-baby clinics", while other countries provide prevention within their general primary care organization. Vaccinations in school age is sometimes carried out within the school health organization but equally much by the basic primary care organization. A more through presentation of the role of school health services for health prevention in childhood will be presented in a forthcoming MOCHA report from WP3, due May 2018.

Evaluation of inequities in primary care models for children.

This report has the ambition to describe systematic inequities in primary care models for children in Europe. As described above these inequities can be defined as "systematic and potentially remediable differences among population groups defined socially, economically, or geographically" [6]. Social groups can be operationalized in many different ways. In this report we will employ those used in the literature in this field, such as gender, socio-economic status of the family, socio-economic status of the neighborhood, education, ethnicity, migrants, refugees, Roma, in the evaluation of inequities in national primary care models.

Quality of care

Ideally, all four dimensions of quality of primary care (access, longitudinality/continuity, comprehensiveness, and coordination) should be assessed in quality studies of primary care and analyzed in relation to robust indicators of health care needs [25], to be able to assess vertical as well as horizontal inequity. Table 4 provides an overview of these four dimensions and how they can be evaluated.

An instrument to be used to evaluate primary care for children in these four dimensions has been developed, The Primary Care Assessment Tool Child Edition, for use in surveys of parents or older children. This instrument contains five scales *Longitudinality: Relationship*, *First-Contact: Accessibility*, *Comprehensiveness: Services Available*, *Comprehensiveness: Services Provided* and *Coordination.* The original instrument *(*Pat-CS) consisted of 44 questions [49] , but a shorter version of 24 questions has also shown good psychometric properties [50]. These instruments, however, have not been used much outside of Spain and The Americas [49-53]. Most European studies of quality of care for children investigate access to care only, usually measured as utilisation of care . Such studies are reviewed later on in this report.

Table 4. **Dimensions of Primary Care for children**, (Rajmil [48] based on Starfield [25]) .

Dimension	Definition	Characteristics	Evaluation
Access and first contact	First contact point for new child health problems. The filter is called the "gatekeeper" and represents a point of contact easy to receive medical assistance as needed	Ease of contact and elimination of geographical, administrative, economic, cultural and political barriers	It is evaluated through access (structure) and the use of services for each new health problem
Longitudinality	Long-term personal relationship between professional and patients and their guardians. The population identifies a care center as "theirs" and establishes a formal or informal contract with the regular care provider and focuses on the person and the family	It reflects the interaction between the individual and the professional over time. It is independent of the presence / absence of disease and the type of health problem. It includes home care	Different ways of evaluating it: identification through a survey of the usual source of health resources used, and the continuity of care over time
Comprehensiveness	It identifies the full range of patients' health needs and the resources to manage them	PC should address most of the signs and symptoms and identify them appropriately. It assumes not only curative, but also preventive and health promotion, and often requires other services such as social work	Range of services available and recognition and identification of needs
Coordination	Continuity of care between healthcare levels. The availability of information about previous problems and the services used, and the management of this information to satisfy the care and needs of the patient and his / her family.	Information has to be generated and used respecting the rights of the patient and needs the assumption by the different specialties of the role of the PC as a pivot of the collaboration between professionals	There are several indices to evaluate continuity of care and risk stratification (Adjusted Clinical group, ACGs, etc)

Ambulatory care-sensitive conditions

Hospital admissions for Ambulatory care–sensitive conditions—those for which timely and effective ambulatory care should prevent hospitalizations—are commonly used proxy indicators of quality in primary care in administrative data in North America [25,54] . The Agency for Healthcare Research and Quality (AHRQ) in the United States had defined a set of Ambulatory care–sensitive conditions for outpatient care for children [55]. In a Canadian study it was found that Ambulatory care–sensitive conditions were responsible for 28% of hospitalizations during the first 2 years of life and close to half

of admissions during the third year. Asthma (30%) and dehydration related to gastroenteritis (19%) were found to be the most common Ambulatory care–sensitive conditions [56].

A British study of adults has shown that hospital admissions because of asthma are less common in populations served by high quality primary care [57], and an Italian study showed important differences in asthma admissions in school children by regions [58], thus supporting the use of hospital admissions for asthma as quality indicator of primary care. Dehydration/gastroenteritis was shown to vary in a similar manner between Italian regions, and to be a particularly useful indicator in infancy and the preschool years [59].

Proxy indicators of quality of preventive health care for children

Preventive health care is an essential part of primary care for children. Vaccination is one of the main preventive interventions for children, and vaccination rates have been suggested as an easily interpretable and fairly accessible indicator of this care [60]. Low vaccination rates have been shown to be associated with characteristics of primary care, such as fragmentation [61].

Another important and universal characteristic of preventive health care is the identification of children with malformations or metabolic disturbances in need of medical or surgical intervention. This post-neonatal screening usually consists of a physical examination by physicians in primary care during regular check-ups. One of the most common of the malformations identified in boys in these examinations is undescended testes/cryptorchidism, where operation is advised before 12 months of age to protect fertility and to prevent the development of cancer [62]. Thus, age at operation for cryptorchidism has been suggested as a proxy indicator for the quality of this part of preventive care, and a suitable measure in studies of equity of equity in terms of primary care provision, as there seems to be minimal socio-economic influence on the incidence and prevalence of cryptorchidism [63]. A complication with this indicator is that the presence of cases of acquired cryptorchidism has been described, as a separate entity for which the efficacy of pre-pubertal surgery has not been unequivocally been demonstrated [64]. There is no consensus among clinicians to what extent cases of acquired cryptorchidism are actually congenital cases that have not been detected [65], and prevalences vary greatly from less than 0.5% of all cases of cryptorchidism reported from Japan [66], to almost two thirds reported from Denmark [67].

Preventive health care during the preschool years often has the ambition to identify developmental delays that affects well-being, or can be ameliorated by interventions [68]. Autism is a severe developmental disorder where early detection has a potential to improve life quality and well-being in

the child [69], and has been identified as a potential quality indicator of preventive health care in a previous MOCHA publication [18].

Aim

This report aims to describe whether national models of primary care for children in the MOCHA countries are equitable, using systematic reviews of the literature as well as a cross-country study based on newly collected data. Patterns of inequity will be investigated in relation to the potential determinants of inequity in access to health care presented in Figure 1. The usefulness of the proxy indicators of quality of primary care for children described above; vaccinations, ambulatory-care sensitive conditions, age at operation for cryptorchidism and age at first diagnosis of autism, will be explored in cross-country comparisons through an equity lens.

2. Systematic reviews.

A first literature search was conducted on November 15th 2016. We searched EmBase, PubMed and Web of Science for empirical studies about equity in utilisation of health care in the 30 MOCHA countries. The following criteria guided the literature search:

a. The study design should be population based, thus excluding clinical samples.
b. The population in the study should include children in the age range 0-17 years of age. If adults were included in the study population, results for children should be presented separately. The study population should also be large enough to provide realistic possibilities to identify differences of at least 5% between different categories of the social indicators in the study.
c. The study population should be drawn from the population in one of the 30 countries of MOCHA.
d. The majority of the data in the study should be collected after January 1'st 2000.
e. The outcome in the study should be directly or indirectly related to health care utilization in primary care.
f. The outcome should be stratified by at least one indicator of SES, migrant status/ethnicity, family situation (lone/cohabiting or married/divorced etc.) or urban/rural residency.

Specific search terms were developed in collaboration with information specialists at the Karolinska Institute University Library and are presented in Appendix 1. Analysis of the literature search identified vaccination rates as the most common outcome in studies that fulfilled the criteria of the review. Therefore, vaccination studies were analysed separately and the first literature search was complemented by a search with specific vaccination criteria. This complementary search was carried out on the 20th July using the same databases as previously interrogated, and using the same search criteria with the addition of the following points:

a. Vaccination rates should be one of the outcomes of the study, studies where delayed vaccinations or attitudes towards vaccinations were the only outcomes were excluded.
b. The vaccine in the study should be a routine vaccine recommended for vaccination of all children in the general population by national health authorities.
c. The majority of the vaccinations in the study should have been made after January 1'st 2000.

Screening and selection process

Two researchers screened titles and abstracts of all unique studies. Studies that were selected to be read in full-text, by both researchers, were then reviewed independently. Any disagreement was

discussed in detail until a common decision was reached. A hand search was conducted from the reference list of all the included articles as well as the systematic reviews detected through the literature search. Experts in vaccination and preventive care in selected MOCHA countries were consulted for information on health statistics that fulfilled the criteria of the study.

Analytic strategy

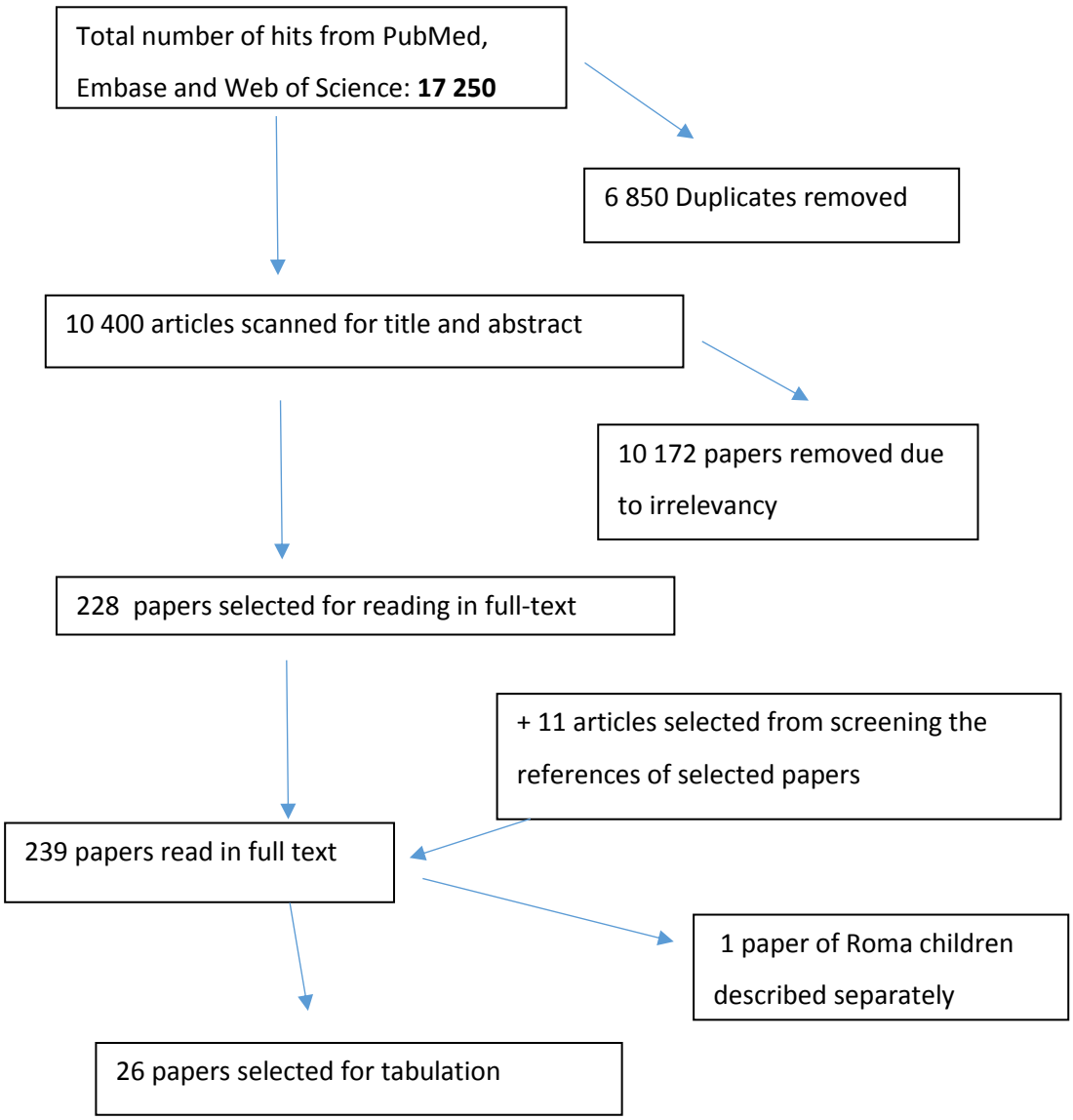
Heterogeneity between the studies concerning type, definition, and measurement of exposure and social indicators made it impossible to analyse the equity outcome in a compact and simplified format. Therefore, a *narrative* approach was chosen in the analysis of the review.

Results

Systematic literature review of health care utilization

The literature searches on health care utilization yielded 10 400 unique papers. After a process that is described in Figure 2, 26 papers with outcomes other than vaccination were identified that fulfilled the criteria of the study: 22 studies of use of curative health services (Table 5) and four that described quality aspects of preventive care (Table 6).

Figure 2. Flow chart of the systematic literature search on health care utilization of children.



The studies described in Table 5 used diverse indicators of health care utilisation including: use of telephone services, visits to GP, use of mental health services, use of emergency health services, use of school health services, drug prescription patterns, missing school and hospital admission in children with asthma, physician visits in children with recurrent abdominal pain. Five studies each were identified from Spain, Germany and the UK, four from Sweden, two from Norway and one each from Greece and Ireland and Norway. The studies covered all age groups from infancy until teenage.

There were only four studies that adjusted the analysis of health care utilization to an indicator of health care need. These indicators were perceived health status in use of primary care physician in Catalonia, Spain (Berra et al, 2006), physical and mental health in Catalonia (Palcio-Viera et al, 2013), morbidity load in Aragon, Spain (Calderon-Loranga et al) and a measure of mental health (SDQ) in use of somatic and mental health services in Germany (Wolfie et al, 2014).

Gender

Around half the identified studies (12) reported patterns of health care use by gender. In northern Norway, Turi et al (2009) reported a much higher use of school health services and also a higher use of GPs among 15-16-year-old girls compared to boys, a pattern that was shown also in use of GP in 5-14 year-olds in Catalonia, Spain by Berra (2006) and by Ivert (2013) for use of mental health care in teenagers in the south of Sweden. In contrast, 11-18 year-old boys and girls were found to have quite similar use of GP in Greece (Giannakopoulos et al, 2010) and of general practitioner and primary care paediatrician in 0-17-year-old children in Germany (Rattay et al 2014).

Family situation

Ivert et al (2013) reported a two-fold increase of use of mental health care in children in single parent households in two studies in southern Sweden, but otherwise family situation was not reported in relation to health care use in the reviewed studies.

Socio-Economic Status

Many different indicators of socio-economic status (SES) were used in the studies described in Table 5: parental education, income, parental occupation and the socio-economic composition of the neighbourhood often expressed as deprivation quintiles/quartiles. SES patterns differed considerably between countries. In Greece, Giannakopoulos reported that adolescents in families with high SES used health care twice as often as those with low SES during the last year. Turi et al (2009) reported a higher use of GP services in Northern Norway by children from high SES families, compared to children in families with a lower SES. In Germany, Rattay (2014) reported a higher use of GP services, but a lower use of primary care paediatrician services in children from low SES backgrounds, compared to those in high SES families; while Wolfie et al (2014) described a higher use of somatic health care, but

a lower use of mental health care in families of low SES compared to families with a higher SES, after adjusting the analysis for a mental health measure (SDQ).

Two interview studies in Catalonia, Spain (Berra et al (2006) and Palacio-Viera (2013)) reported a fairly equitable use of health care by children aged 5-14 years and 8-18 years, after adjusting for indicators of health care needs. In southern Sweden, Mangrio et al (2011) described a higher use of GP in preschool children from families with low SES, compared to those with high SES and Ivert (2013) found a similar pattern in adolescent use of mental health care. In Scotland, Wilson et al (2013) reported that families used GP services as a source of information for their children similarly despite their SES background.

Patterns of use of telephone advice from the United Kingdom NHS telephone service were reported by two studies. Cooper et al (2005) found that families from less deprived areas used this service more often in the age group 5-14 years, while use of the service was more equitable during the pre-school years. These findings were followed up by Cook et al (2012), who found that deprivation patterns differed by gender of the child. More deprived families of girls used this service more often, but in boys, the more deprived families used the services less.

In the only study identified of children diagnosed with asthma, Austin et al (2005) found that children from more deprived neighbourhoods in Scotland were more often admitted to hospital and missed school more often because of their asthma condition compared with children from less deprived areas.

Migrants/minorities

There were a number of different categorisations used to identify minority and migrant children in the research papers identified in the systematic review. A Norwegian study by Fadnes et al (2016) showed the importance of using similar categories of migrant/minority children. They reported that children who were foreign-born used less primary and emergency hospital care; while the opposite was true for children born in Norway to foreign-born parents. In Spain, children with foreign-born parents in the region of Aragon were found to visit primary care less often (Gimeno-Feliu et al, 2011) and be prescribed drugs less often (Gimeno-Feliu et al, 2011), compared with children with Spanish-born parents. In a register study by Calderon-Larranga et al (2011) from the same region, adjustment for a morbidity indicator normalised this association, suggesting that the earlier finding could be explained by better health in the migrant children.

Ivert et al (2011) described the barriers to using mental health care services by adolescents with foreign-born parents in Stockholm; and in a further study (2013) in southern Sweden described that this was particularly pertinent for children with foreign-born parents who originated from low and middle income countries; but not those with parents originating from other high income countries. In the single study identified of children of undocumented children, Wenner et al, in Germany, found that migrant children without residency used emergency health services more than twice as frequently compared to children in migrant families who had been granted residency.

Regional differences

Two German studies describe the difference in health care utilisation between the former East and West Germany. Children in the East use more health care, in particular family physicians in primary care, while children in the former West Germany were more likely to visit a primary care paediatrician (Rattay et al 2014; Hinzpeter et al, 2015). According to Rattay et al (2014) this pattern has been consistent between 2003-2006 and 2009-2012.

Table 5: Studies of utilization of health care for disease in children in EU/EES countries

Authors Publication Year Title	**N**	**Age Span**	**Location and year of data collection**	**Study design**	**Exposure**	**Outcome**	
Rattay et al., 2014 *Trends in the utilization of outpatient medical care in childhood and adolescence. Results of the KiGGS study*.		0 -17yrs 17 254 and 12 102	Germany 2003-2006, 2009-2012	National survey (KiGGs Wave 1)		Last 12 mths 2003-2006 GP use	Last 12 mths 2009-2012 GP use
					Gender	%	%
					Boy	*34.2*	*34.1*
					Girl	*33.7*	*33.8*
					Region		
					Former West	36.3(ref)	35.9(ref)
					Former East	24.1*	24.8*
					Urbanicity		
					Rural	44.6*	42.1*
					Smal city	30.7	30.2
					Large city	25.8(ref)	30.5(ref)
					SES		
					Low	30.9	35.8*
					Middle	36.5*	35.4*
					High	29.4(ref)	28.2(ref)
						Paediatr use	Paediatr use
					Gender	%	%
					Boy	59.2	67.9
					Girl	59.5	68.7
					Region		
					Former West	56.7(ref)	66.0(ref)
					Former East	71.7*	77.6*

					Urbanicity		
					Rural	51.9*	62.8*
					Small city	64.3	69.7
					Large city	64.9(ref)	69.7(ref)
					SES		
					Low	59.9	66.4*
					Middle	58.2*	67.4*
					High	62.7(ref)	70.9(ref)
Wolfle et al., 2014 *Somatic and mental health service use of children and adolescents in Germany KiGGS-study.* 2014	6 475	11 – 18 yrs	Germany 2003-2006	National health survey (KIGGS)	*SES* Low Medium High	*Somatic health care Beta-coeffic*[a] 0.356 0.364 (ref) [a] is djusted for SDQ score	*Mental health care Beta-coefficent*[a] - 0.294 - 0.195 (ref) [a] is adjusted for SDQ score
Hintzpeter et al., 2015 *Mental health care use among children and adolescents in Germany: results of the longitudinal BELLA study.*	2 863	7-17 yrs	Germany 2004-2007	National Health Survey (KiGGS)		Children living in former East Germany and larger communities used mental health services more. No gender differences nor differences in between children with foreign-born and native parents.	
Hirschfeld, 2015 Physician consultation in young children with recurrent pain – a population-based…	2 149	3-10 yrs	Germany 2003-2006	National Health Survey (KiGGS)		Children with foreign-born parents are more likely to visit physician when they have recurrent pain	
Wenner, Razum, Schenk, Ellert, & Bozorgmehr, 2016 *Health status and use of health services of children with insecure residence status in Germany.*	17 245	2-17 yrs	Germany 2003-6	National health Survey (KIGGS)		Use of emergency health services	
					Gender	OR	
					Boys	*(ref)*	
					Girls	*0.80**	
					Par Education		
					Low	*0.93*	
					Middle	*0.78**	
					High	*(ref)*	
					Residential status		
					Secure	(ref)	
					Unsecure (migrant)	2.53*	
					Foreign-born parents		
					Yes	0,91	
					No	(ref)	

Giannakopoulos, Tzavara, Dimitrakaki, Ravens-Sieberer, & Tountas, 2010 *Adolescent health care use: Investigating related determinants in Greece.*	894/1 194	11-18 yrs	Greece 2003	National survey	*Gender* Boy Girl *Parent report SES* Low Medium High *Urbanicity* Rural Small city Large city	Any health care use last 12 mths, % 14.6 15.1 9.5(ref) 16.0* 19.9* 14.7 13.2 17.2	
Layte & Nolan, 2015 Eligibility for free GOP care and the utilisation of GP services by children in Ireland and Scotland	9 538 6 985	9 month 9 year	Ireland 2008-2009	National Survey	*Deprivation quintiles*	Children in the lowest quintiles use more care than children in the highest quintiles. Among children who have out of pocket fees, however, the more affluent consume more care	
Turi, Bals, Skre, & Kvernmo, 2009 *Health service use in indigenous Sami and non-indigenous youth in North Norway: A population based survey.*	63 648	15–16 yrs	Norway (Northern Norway 2003-2005)	Regional Survey	*Gender* Boys Girls *SES* Low High *Ethnicity* Majority Sami	School health use OR (ref) 3.43* (ref) 1.15 (ref) 0.56	GP use OR (ref) 1.64* (ref) 1.27* (ref) 1.45
Fadnes, Moen, & Diaz, 2016 Primary healthcare usage and morbidity among immigrant children compared with non-immigrant children: a population-based study in Norway	1 168 365	0-18 yrs	Norway 2008	National register	*At least one Norwegian-born parent* *Immigrants* HIC countries MIC countrie LIC countries *Children of immigrants* HIC countries MIC countrie LIC countries	Mean GPuse 1.23(ref) 0.86* 0.99* 1.12* 1.39* 1.59* 1.95*	Mean ER use 0.18(ref) 0.11* 0.13* 0.11* 0.21 0.29* 0.34*
Berra et al., 2006 *Perceived health status and use of healthcare services among children and adolescents.*	836	5-14 yrs	Spain (Catalunya), 2006	Population survey	*Gender* Boy Girl *SES* Low Middle High *Parental ed* Low	*Visit to primary care* [a] % 22.8 33.1 23.0 20.1 18.9 19.6	*Hospital adm* [a] % *4.2* *3.5* 3.9 3.5 4.3 4.8

					Middle High	22.4 20.1 [a]adj for mneed	3.4 2.9 [a]adj for mneed
Calderon-Larranaga et al., 2011 Primary care utilisation patterns among an urban immigrant population in the Spanish National Health	7 865	0-14 yrs	Spain (Aragon) 2007	Medical records	 Spanish Immigrant	Planned visit IRR[a] 1 1.10* [a]adj for mneed	Emer-gency visit IRR[a] 1 0.68* [a]adj for mneed
Palacio-Vieira et al., 2013 *Predictors of the use of healthcare services in children and adolescents in Spain.*	454 (response rate 54%)	8- 18 yrs	Spain 2003, 2006	Phone Interview survey KIDSCREEN	*Gender* Boys Girls *Parental education* High Medium Low *Financial resources* Low Medium/high *Health care coverage* Only public Double	Total use of health care last 12 mths 88.5 90.6 89.7 89.8 90.7 93.5 88.7 88.7 92.9	
Gimeno-Feliu, Armesto-Gomez, Macipe-Costa, & Magallon-Botaya, 2009 Comparative study of paediatric prescription..	159 908	0-14 yrs	Spain (Aragon) 2006	Health Service database	 Immigrant Children Native Children	Prescribed drugs DID (daily doses/ 1000 pers/day) 66 * 114 (ref)	
Gimeno-Feliu et al., 2011 Frequency of attending Primary Care clinics	2 452	0-14 yrs	Spain (Aragon) 2006	Medical records (Registry)	 Immigrant children Native children	*Primary care Attendance* 4.8 visits * 7.1 visits (ref)	
Mangrio, Hansen, Lindstrom, Kohler, & Rosvall, 2011 *Maternal educational level, parental*	9 289	8 mths	Sweden (Scania) 2003-2007	Regional survey	*Maternal education* 0-9 years 10-12 years 13+ years	Physician visit OR 1.28* 1.27* (ref)	
Ivert et al., 2011 *Pathways to child and adolescent psychiatric clinics: A multilevel study of the significance*	2 054	11 – 19 yrs	Sweden Stock-holm 2000-2005	Stockholm Child-psych database. Patient records	*Initiation of mental health care*	Children with foreign-born parents and living in low SES neighbourhood were more often referred to mental health care	

of ethnicity and neighbourhood social characteristics on source of referral.						from social services and school and less often referred by their parents.
Ivert, Merlo, Svensson, & Levander, 2013 *Adolescents' utilisation of psychiatric care, neighbourhoods and neighbourhood socioeconomic deprivation: A multilevel analysis***.**	18 417	13 – 18 yrs	Sweden (Scania) 2004	Regional Database with population data and data from patient records.	*Gender* *Boys* Girls Family *Income* Low Middle Low *Par Education* High Middle Low *Family situation* Living with both parents Single parent Other	Mental Health care OR (ref) 1.51* 1.22* 1.04 (ref) (ref) 1.15* 1.20* (ref) 1.73* 2.64*
Ivert et al., 2013 *How are immigrant background and gender associated with the utilisation of psychiatric care among adolescents?*	92 203	13 - 18	Sweden (Scania) 2005	Register	*Gender* Boys Girls *Family Income* High Middle Low *Par Education* High Middle Low *Family situation* Living with both parents Other *Parental country of birth* Sweden HI country MI country LI country *Urbanicity* Rural Small city Large city	*Any Mental Health care* OR (ref) 1.68* (ref) 1.07 0.99 0.91 0.99 (ref) (ref) 2.14* *Outpatient care* OR (ref) 0.99 0.65 * 0.55 * (ref) 1.02 1.16*

Cooper et al., 2005	57 662 (number of calls)	0-14 yrs	UK (West Yorkshire) 2001-2002	Registry study	*Gender* Boys Girls *Deprivation* quintiles 1 (Lowest) 2 3 4 5	NHS direct calls, 1-4 yrs RR (ref) 0.93 (ref) 1.06 1.28* 1.10 0.80*	NHS direct calls 5-14 yrs RR (ref) 0.98 (ref) 1.24 1.63* 1.61* 1.32*
Austin, Selvaraj, Godden, & Russell, 2005 Deprivation, smoking, and quality of life in asthma	4665	13-14 yrs	UK (Scotland) 2002	Cross-sectional population survey (ISAAC)	*Deprivation quartile* *(Highest)* *2* *3* *4*	Children with asthma: Missed school % 18.9(ref) 23.3 * 23.4 * 30.8 *	Children with asthma: Hospital admission % 5.7 (ref) 4.6 8.1 * 7.0 *
Wilson, Hogg, Henderson, & Wilson, 2013 *Patterns of primary care service use by families with young children.*	8 076	0–3 yrs	UK (Scotland) 2005-6	Child cohort study (Growing up in Scotland)	*Deprivation SIMD 2006* *1 (Lowest)* *2* *3* *4* *5* *Ethnicity* *White* *Other*	GP use OR 1.16, 1.08 1.18 1.23* (ref) (ref) 0.85	
Layte & Nolan, 2015 Eligibility for free GOP care and the utilisation of GP services by child…	9 538 6 985	9 month 9 year	UK (Scotland) 2008-2009	Population Survey	*Deprivation quintiles*	No differences in use of health between children in different deprivation quintiles	
Cook, Randhawa, Large, Guppy, & Chater, 2012 *A UK Case Study of Who Uses NHS Direct: Investigating the Impact of Age, Gender, and Deprivation on…*	359 758 (number of calls)	0-15 yrs	UK (England) July 2010	Registry study	*Deprivation* quintiles 1 (Lowest) 2 3 4 5	NHS direct calls, Boys RR (ref) 1.08 1.12* 1.14* 1.03	NHS direct calls, Girls RR (ref) 0.90 0.85* 0.77* 0.70*

Use of preventive health services

Table 6 describes four identified studies about use of preventive health care services, which fulfilled the criteria of the literature search. Two studies, from Germany (Rosenkötter et al, 2012) and Denmark (Sondergaard et al, 2008), show a lower participation in preventive screenings of pre-school children in low SES and immigrant families. In contrast, Wilson et al (2013) in Scotland showed a greater participation of children in low SES families in home visiting programs and a Swedish study by Wallby & Hjern (2011) showed a relatively equitable use of preventive health services during the first two years of life.

Table 6. Studies on utilisation of preventive health care.

Authors Publication Year Title	N	Age	Location and year of data collection	Study design	Exposure	Outcome	
Sondergaard, Biering-Sorensen, Michelsen, Schnor, & Andersen, 2008 *Non-participation in preventive child health examinations at the general practitioner in Denmark: a register-based study.* 2008	67 191/ 63 648	0-5 yrs	Denmark 2002-2004	National register study in two national cohorts		Particip in prev GP exam *5 mths*	Particip in prev GP exam *4 yrs*
					Gender	*%*	*%*
					Boys	94.0	*76.7*
					Girl	93.7	*76.7*
					Maternal SES		
					Low	90.5(ref)	63.8(ref)
					Middle	93.2*	73.8*
					High	95.4*	81.3*
					Household income		
					<1%	79.8*	51.5*
					1-4.9%	87.7*	57.1*
					5-24%	91.5*	66.6*
					25-49.9%	94.5*	82.4
					50-74.9%	95.5	82.4
					75+%	95.3 (ref)	81.8(ref)
					Maternal country of birth		
					Danish	94.4 (ref)	78.7 (ref)
					Born in LIC or MIC country	92.2 *	65.8 *
					Born in HIC country	91.0 *	63.6 *
						91.3 *	68.9
Rosenkötter, Van Dongen, Hellmeier, Simon, & Dagnelie, 2012 *The influence of migratory background and parental education on health care*	52 171	61 - 82 months	Germany (North Rhine-Westphalia) 2007	School entry screen data		Incomplete participation in preschool screening %	
					Parental education		
					Low	45.5*	
					Medium	22.3	
					High	20.7(ref)	
					Single parent		
					Yes	43.5*	
					No	27.8(ref)	

utilisation of children.					*Migrant background*		
					Yes	53.5*	
					No	30.7(ref)	
					Urbanicity		
					Rural	30.6 (ref)	
					Small city	27.6	
					Large city	35.4 *	
Wallby & Hjern, 2011 *Child health care uptake among low-income and immigrant families in a Swedish county.*	25 024	0-6 yrs	Sweden (Uppsala county) 2000-2008	Regional Child Health Register Study		*At least one home visit %*	*At least 3 GP exams %*
					Disposable income quartiles		
					1 (Lowest)	*79.7**	*90.2*
					2	*83.6*	*93.1*
					3	*84.7*	*93.1*
					4 (Highest)	*85.5*	*92,9*
					Migrant status		
					Two parents born outside Europe	*76.8*	*89.5*
					One parent born outside Europe	*83.7*	*92.9*
					Both Swedish-born	*84.9*	*92.8*
						Mean number of visits to nurse	
					Disposable income quartiles		
					1 (Lowest)	13.7*	
					2	14.7*	
					3	15.0	
					4	15.2(ref)	
					Migrant status		
					Two parents born outside Europe	14.9	
					One parent born outside Eurooe	14.2	
					Both Swedish-born	14.8	
Wilson et al., 2013 *Patterns of primary care service use by families with young children.* 2013	8 076	0 - 3	UK (Scotland) (2005-6)	Child cohort study (Growing up in Scotland)	*Deprivation* SIMD 2006	Home visitor use OR	
					1 (Lowest)	1.72*,	
					2	1.48*	
					3	1.48*	
					4	1.27	
					5	(ref)	
					Ethnicity		
					White	(ref)	
					Other	0.79	

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Table 5.

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Table 6.

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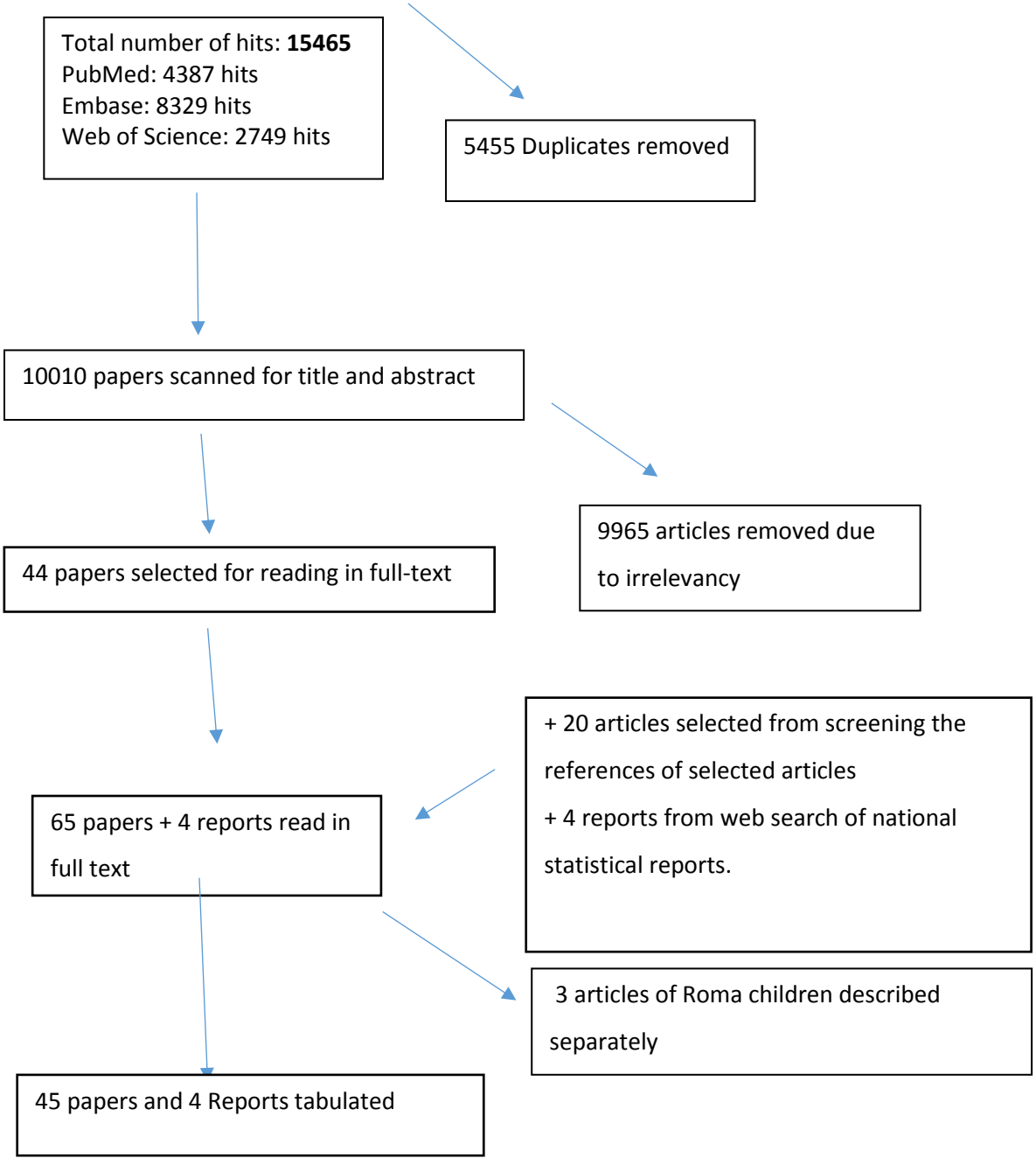
Systematic review of vaccinations

The literature search on vaccination yielded 10010 unique papers. Figure 3 describes the process followed to retrieve 47 papers about 44 studies and 2 reports. These fulfilled the criteria of the literature search. Thirty studies and two reports described vaccinations during the preschool years, 13 studies and one report vaccinations in school age children and two studies describe vaccinations in both pre-school and school age. Preschool (Table 7) and school age vaccinations (Table 8) are presented separately, because they are often delivered by different primary health care providers.

Figure 3. Flowchart of the systematic review of vaccinations



Preschool vaccinations

The preschool studies included different vaccines: Measles-mumps-rubella (MMR) diphtheria-tetanus-pertussis (DTP) were the most common, but studies of vaccination against hepatitis B, multicomponent vaccines, and rotavirus were also included. Some studies used outcomes such as "complete vaccination" according to a recommended schedule. Eight studies originated in England, five in Germany, four in Belgium, three in Greece, two in Austria, Ireland, Italy, and Sweden and one each from France, Ireland, Norway and Spain.

The reviewed studies covered the years 2000-2015. Older studies were primarily based on surveys of comparatively small random samples of populations, with or without vaccination booklets, while many of the more recent studies, from Denmark, the Netherlands and Norway, were based on national vaccination registers containing entire national cohorts or random samples of such cohorts. A vaccination coverage of over 90% was reported from most countries for vaccinations during the first two years, with the exception of Austria, Belgium, Denmark and France.

Gender

There were only eight studies that reported vaccination rates by gender. In four of these (Pearce et al, 2008; Hungerford et al, 2016; Jessop 2009; Woesterberg, 2014) girls had slightly, but statistically significant, higher rates of vaccinations and in four studies there were no significant differences.

Family situation

Vaccination rates of children in different family situations were reported in five studies. In a German study (Rosenkötter et al, 2012), children in lone parent families had slightly lower vaccination coverage, something which was also shown in two English studies (Samad, 2006; Pearce et al, 2008). Studies in Ireland (Jessop, 2009), Spain (Borras et al, 2007, 2009) and Sweden (Wallby et al, 2013) showed more similar vaccination rates in one and two parent families.

Socio Economic Status

Patterns of socio-economic status (SES) differed considerably between countries. A study from Austria (Stronegger, 2010) showed considerably lower vaccination rates for measles containing vaccine in children in families where parents have low education compared with children in families of highly educated parents. Similar results were reported to a lesser degree from England by Pearce et al (2008) and Hungerford (2016), and from Belgium by Vandermewulen et al (2008), Scotland (Information service, 2016) and Sweden (Wallby et al, 2013). For other vaccines, rates of uptake were slightly lower in low SES families compared to children in high SES families in the Netherlands (van Lier et al, 2013),

while in the other countries in our review vaccination patterns were found to be quite equitable in all SES groups.

Slightly lower vaccination rates in children from high SES families compared with low SES were found for MMR in Barvaria (Kalies et al, 2008) and Germany as a whole (Poethko-Muller et al, 2009). Three studies from Greece produce conflicting results with regards to SES. Danis et al (2010), in a study of vaccination booklets at school entry found much lower rates in children of parents with less education, compared to children of parents who had more education. In contrast, Georgakopoulou et al (2013) found very high vaccination rates with no differences between SES groups in children in nursery schools.

Migrants/minorities

Newly settled refugee children were found to have lower vaccination coverage than the majority population in Denmark (Möller et al, 2016), and children in migrant families without residency were more likely to have incomplete vaccination status than the majority population in Germany (Wenner, 2016). In England, Asian minority populations have been shown to have higher vaccination rates compared to children in ethnic white families (Mixer et al, 2007; Baker eta al (2011). In Norway, Riise et al (2015) and Feiring et al (2016) have shown that children with foreign-born parents who originated from where the BCG (Tuberculosis)-vaccination is recommended. have slightly lower vaccine coverage than the majority population. Again, conflicting evidence is reported from Greece, where Danis et al (2010) report much lower vaccination coverage in children in “immigrant”, Muslim and Roma families, while Georgakopoulou et al (2013) found no differences in vaccination rates between children with immigrants and non-immigrant background in nursery schools.

Regional differences

Regional differences in vaccination rates were reported from Germany, where children living in former East Germany were more often vaccinated with MMR compared to those in the former West Germany (Poetko-Muller et al, 2009), and children living in Bavaria were found to have lower vaccination rates than other parts of Germany (Kalies et al, 2006). In the UK, vaccination rates were higher in Northern Ireland than in other parts of the United Kingdom (Samad et al, 2006; Pearce et al, 2008), and in France Fontenau (2013) described lower vaccination rates of hepatitis B and MMR vaccination in rural compared to urban areas.

Table 7. Systematic review of vaccination in social context during the preschool years.

Authors Title Publication year	N	Age	Location and Year of Data Collection	Study Design and source of vacc data	Exposure	Outcomes
Stronegger & Freidl, 2010 A hierarchical analysis of social determinants of measles vaccination coverage in Austrian schoolchildren	2 386	2 yrs	Austria (Styria)	Cross-sectional survey in classroom cluster sample.	*Gender* Male Female *Pat Education* Compulsory Apprentice High school University *One-parent family* Yes No *Place of residence* Urban Rural	Measles % 82.1 82.6 74.9 * 82.1 * 85.2 * 88.0 (ref) 82.4 82.4 86.0 (ref) 81.7 *
Klimont & Baldaszti, 2015	553	2 yrs	Austria 2014	Cross-sectional survey	*Income* 1 (Lowest) 2 3 4 5	Measles % 50* 55* 65 64 63 (ref)
Theeten et al., 2007 Infant vaccination coverage in 2005 and predictive factors….	1 354	18-24 mths	Belgium (Flanders) 2005	Cross-sectional survey	*Total rate*	Complete vaccination 90.5% No differences by maternal employment or family income
Vandermeulen, Roelants, Theeten, Van Damme, & Hoppenbrouwers, 2008 Vaccination coverage and sociodemographic determinants of measles-mumps-rubella vaccination in three different age groups	1349 + 792	12-24 mths	Belgium (Flanders) 2005	Cross-sectional survey. Vaccination cards.	*Maternal Ethnicity* Belgian European Non-European *Mat Education* Primary Secondary Post-sec *Monthly family income (euros)* <1500 euros 1500-2000 2000-3000 > 3000	MMR1 Toddler *%* 94.4 (ref) 93.4 91.9 * 94.6 (ref) 92.9 94.4 92.0 * 94.5 95.9 (ref) 93.9

Robert, Dramaix, & Swennen, 2014 Vaccination Coverage for Infants: Cross-Sectional Studies in Two Regions of Belgium	495	18-25 mths	Belgium (Brussels and Wallonia) 2012	Cross-sectional survey.	*Population rate* *Family Income/month* < € 2000 2001-3000 € 3001-4000 € > 4000€	Rota virus incomplete 9.5% OR (ref) 0.38* 0.32* 0.18*	
Braeckman et al., 2014 Rotavirus vaccination coverage and adherence to recommended age among infants in Flanders Belgium in 2012	874	1-2 yrs	Belgium (Flanders) 2012	Cross-sectional survey.	*Mat education* Secondary or >Secondary *Maternal ethnicity* Belgian Other *Mat emplotement* Unemployed, part time Full time, self-employed	Complete Vacc Wallonia % 80.8 82.9 81.2 84.0 81.9 82.4	Complete Vacc Brussels % 81.6 84.4 78.7 85.1 81.3 * 88.5 (ref)
Moller, Hjern, Andersen, & Norredam, 2016 Differences in uptake …	116 907	1-5 yrs	Denmark 1993-2012	National Register study	*Origin of children* Danish-born refugees	DTP 5 yrs % 73 (ref) 47 *	MMR1 % 76 (ref) 72 *
Fonteneau et al., 2013 Vaccination coverage in 6-year-old preschool children, France, 2005–2006	21 346	<6 yrs	France 2005-2006	National survey	*Profession of the father* Farmer Craftsmam etc Superior Executive or Profession Intermediate occupation Employee Qualified worker Unskilled worker *Urban unit size* < 20 000 inhabitants ≥ 20 000 habitants	Hepatitis B % 28.3(ref) 34.5 35.3 35.2 38.0 40.0* 42.2* 32.9(ref) 41.3 *	MMR 2 doses % 33.2 (ref) 41.5 45.5 * 45.0 * 47.0 * 45.8 * 45.7* 39.6(ref) 49.0 *
Kalies, Grote, Schmitt, & von Kries, 2006	2 701	2 yrs	Germany 1998-2005	Cross sectional telephoness urvey. Health cards.	Regions Berlin, Hamburg, Bremen	MMR1 % 73(ref) 58*	DPTetc % 83 (ref) 72*

Immunisation status of children					Bavaria		
Mikolajczyk, Akmatov, Stich, Kramer, & Kretzschmar, 2008 Association between acculturation and childhood vaccination coverage in migrant population	2 043	5-6 yrs	Germany (Barvaria) 2004-2005	Cross sectional survey. Health cards.	*Accult status* Indigenous More accult Less accult *Gender* Male Female *Parent Education* Lower for both Higher for one Higher for both	Not vaccinated with MMR % 6.9 (ref) 7.3 6.8 7.2 (ref) 6.5 6.0 5.2 * 8.7 (ref)	Not vaccinated with HBV % 13.3 (ref) 8.8 4.3 * 12.8 (ref) 11.1 8.8 12.6 15.9 (ref)
Wenner, Razum, Schenk, Ellert, & Bozorgmehr, 2016 The health of children ….	17 245	2-17 years	Germany	National survey 2003-2006 (KiGGS)	*Residential status* Uncertain Secure	Incomplete vaccination % 35 * 24 ref	
Poethko-Muller et al., 2009 Vaccination coverage against measles in German-born and foreign-born children and identification of unvaccinated subgroups in Germany	14 826	2-17	Germany 2003-2005	Cross-sectional national survey (KIGGS). Vaccination cards.	*Gender* Male Female *Place of residence* Former East Ger Former West Ger *SES* Low Medium High *Migrant status* No migration background First-generation Second-gen	No MMR % 6.4 6.3 3.1 (ref) 7.0 * 5.1 (ref) 5.8 8.4 * 6.3 (ref) 12.9 * 5.0 *	
Rosenkotter, van Dongen, Hellmeier, Simon, & Dagnelie, 2012 The influence of migratory background and parental education on health care	52 171	61-82 mths	Germany (North Rhine-Westfalia) 2007	Total population study. Vaccination booklet	*Migrant family* Yes. No. *Par Education* Low Medium High *Single parent* Yes No	At least one missing vacc % 60.9 58.8 61.7 (ref) 57.1 * 55.6* 63.1* 57.7(ref)	

utilisation of children.					Area type Rural Urban	 59.7 (ref) 57.8 *	
Danis, Georgakopoulou, Stavrou, Laggas, & Panagiotopoulos, 2010 Socioeconomic factors play a more important role in childhood vaccination coverage than parental perception : a cross-sectional study in Greece	3 878	6 yrs	Greece 2004-2005	National survey with classroom sampling. Vaccination booklet and questionnaire	*Child's gender* Female Male *Residency* Rural Urban *Minority status* Majority Immigrant family Greek muslims Roma *Country of birth* Greece Other *Par education* <High school High school >High school	Complete vaccination % 63.8 (ref) 63.9 58.7 (ref) 65.1 67.1 (ref) 29.9 * 52.8 * 40.1 * 65.7 (ref) 30.5 * 53.9 (ref) 63.3 * 69.0 *	
Pavlopoulou, Michail, Samoli, & et.al., 2013, 2014 Immunization coverage and predictive factors for completed	730	2-6 year	Greece (Athens) 2010-2011. Children in public nurseries	Cross-sectional stuy Vaccination booklets.	*Population rate* *Fathers national* Other Greek *Mat education* ≤ 12 years 13 + years	DTP/DTaP, OPV/IPV, MMR, Hib, HBV 56.9% OR (95%) (ref) 1.56 * ref) 0.84	MenC, PCV7, Var 44.2% OR (95%) (ref) 1.29 (ref) 0.73
Georgakopoulou et al., 2017 A cross-sectional vaccination coverage study in	2 539	2-3 yrs	Greece 2013 National sample of children in kindergarten.	Cross-sectional study of vaccination booklets.	 General pop Child in immigrant family	Polio 4 doses % 95.8 94.3	DPT 4 doses % 95.8 94.3
Jessop, L. 2009. Socio-demographic and health-related predictors of uptake of first MMR immunisation in the Lifeways Cohort Study	749 /1070	<5	Ireland 2001-2004	Child cohort study. Vaccination records and questionnaire.	*Gender* Female Male *Not working* No Yes *Maternal education* ≤ Secondary level Higher level *Region*	MMR % 92.0 (ref) 85.5 * 90.5 (ref) 85.2 * 89.9 87.8	

					East	91.6 (ref)	
					West	83.8 *	
					Not married		
					No	89.5	
					Yes	86.9	
					Income /week		
					>£ 300	90.3 (ref)	
					<£ 300	82.2 *	
Doherty, Walsh, & O'Neill, 2014 Decomposing socioeconomic inequality in child vaccination: Results from Ireland	9 581/ 11 000	9 mths	Ireland 2008-2009	Nationally representative survey		Non-receipt of vaccination % in decomposition results of linear regression	
					Social class	29,9	
					Household structure	24	
					Urban location	0.4	
					income	24	
					Education	-2.5	
					Ethnicity	-14.9	
					Employment	6.1	
Ciofi Degli Atti, Rota, Bella, Salmaso, & Group, 2004 Do changes in policy affect vaccine coverage levels? Results of a national study to evaluate childhood vaccination coverage and	4 602	1-2 yrs	Italy 2003	National survey	*Regional information*	% Polio	% DTP
					North of Italy	95.5 (ref)	95.7 (ref)
					Centre of Italy	96.4	96.3
					South of Italy	95.7	95.7
						Pertussis	HBV
					North of Italy	94.5 (ref)	95.2 (ref)
					Centre of Italy	96.1 *	95.9
					South of Italy	95.5	95.6
						MMR	HIB
					North of Italy	80.2 (ref)	90.2 (ref)
					Centre of Italy	78.1	83.6
					South of Italy	73.2	85.2
Anello et al., 2017 Socioeconomic factors influencing childhood vaccination in two	48 454	2 yrs	Italy (Friuli-Venezia/ Giulia) 2006-2010	Population based register study		MMR %	
					Citizenship		
					Italian	90.0 (ref)	
					Other	91.9*	
					Maternal edu		
					Low	92.8	
					Intermediate	90.9	
					High	87.4	
Van Lier, 2013 Vaccine uptake determinants in the Netherlands	180 456	0-1 yrs	Netherlands 2005-2006	National Register study	*Country of birth of parents*	Full coverage % Differences of 0-2 %	
					Netherlands vs foreign-born parents		
					Socio-economic status	93.7(ref)	
						94.2*	
					Low SES	94.7*	
					Low average	95.6*	
					High average		
					High SES		

Riise et al., 2015 Monitoring of timely and delayed vaccination…	63 382	1-2 yrs	Norway 2010-2012	National Register study	"TB risk population" Others	Complete vacc % 88.3 * 93.6 (ref)	
Feiring et al., 2016 Do selective immunisation …	201 693 gen pop+ 38 791 with "TB-risk"	24 mths	Norway 2009-2012		Parental country of birth "TB_risk" Other	3+ Pertussis % 92.3* 96.5 (ref)	
Borras et al., 2007; Borras, Dominguez, Oviedo, Batalla, & Salleras, 2009 Vaccination coverage in indigenous and immigrant c	630	0-3yrs	Spain (Catalonia) 2003-2004	Retrospective cross-sectional telephone survey	*Family* Two-parent Single-parent *Mat. education* <12 years ≥ 12 years *Pat. education* <12 years ≥ 12 years *Social class* Low High *Occupation* Active Inactive	*Complete* % Indigenous 96.7 (ref) 87.5 96.6 (ref) 96.7 98.7 (ref) 96.7 * 87.56 88.26 (ref) 88.03 90.00 (ref)	*Complete* % Immigrant 84.7 (ref) 100 78.6 (ref) 93.3 85.7 (ref) 86.7 *
Wallby & Hjern, 2011 Child health care uptake among low-income and immigrant families in a Swedish county.	25 024	0-2 years	Sweden (Uppsala county 2000-2008)	Total population study. Child health records	*Parental region of birth (Both)* Swedish West Europe South or East Europe Non-European *Disposable Income* Quartile 1 Quartile 2 Quartile 3 Quartile 4	DTP-Polio-Hib % 98.8 90.4 94.6 96.3 97.1 98.9 99.0 99.0	MMR % 93.3 77.9 88.2 92.3 90.5* 93.3 93.7 93.9(ref)
Wallby, Modin, & Hjern, 2013 Child health care utilization in families with young or single mothers in a Swedish county	10 692	0-2	Sweden	Total population study. Child health records	*Maternal age* 13-21 22-30 30-48 *Family situation* Mother cohabiting or married Single mother	DTP-Polio-Hib % 98.6 98.9 98.4 98.6 98.2´	MMR % 94.2 93.6 92.5 93.4 92.1

Mixer, Jamrozik, & Newsom, 2007 Ethnicity as a correlate of	6 444	1-3 yrs	UK (London) 2003	GP Records	*Ethnicity* Asian Black White	MMR 1 % 85.7 * 78.0 * 64.9 (ref)	
Samad et al., 2006 Differences in risk factors for partial and no immunisation in the first year of life: prospective cohort study	18 488	9 mth	UK (England) 2000-2003	Child cohort study (Millenium)	*Population rate* *Country* England Wales Scotland Northern Ireland *Ward type* Advantaged Disadvantaged Ethnic *Lone parenthood* No Yes	Lacks some vacc 3.6% RR (ref) 0.9 0.9 0.6* (ref) 1.3 (*) 1.6 * (ref) 1.5*	
Pearce et al., 2008 Factors associated with Uptake of Measles, Mumps, and Rubella Vaccine MMR and Use of Single Antigen Vaccines in a Contemporary UK Cohort: Prospective Cohort Study. Jayaweera & Quigley, 2010 **Health status, health behaviour and healthcare use among migrants in the UK: evidence from mothers in the Millennium Cohort Study**	14 578/ 18 819	3yrs	UK (England) 2003-2005	Millenium cohort study. Interviews.	*Total rate* *Gender of child* Male Female *Country* England Wales Scotland N Ireland *Single Parent* No Yes *Maternal employment* Full time Part time Not employed Self employed *Mat education* None 0 level/GCSE grades A*-C A/AS level Diploma Born UK Foreign-born	Unimmunised MMR 11.4% RR (ref) 0.84 * (ref) 1.24 * 0.88 * 0.60 * (ref) 1.30 * (ref) 1.07 * 1.43 * 1.71 * (ref) 1.35 * 1.15 * 1.41* No vaccination % 1.2(ref) 1.9*	
Baker, Garrow, & Shiels, 2011 Inequalities in immunization and breast	20 203 (triple vaccine)	11-19 mths	UK (Man-chester) 2002-2007	Cross-sectional survey	*Ethnic group* All ethnic groups White	*MMR* % 90 88 (ref) 90	DPT % 93 92 (ref) 91

feeding in an ethnically diverse urban area: cross-sectional study in Manchester, UK	11 261 MMR vaccine.				Mixed Pakistani Indian Bangladeshi Black/Black British	95 * 96 * 95 * 90 *	95 * 94 96 * 94 *
Wagner, van Wijgerden, Andrews, Goulden, & White, 2014 Childhood vaccination coverage by ethnicity within London between 2006/2007 and 2010/2011	305 381	1-5	UK (London) 2006-2011	Total population study. Child health records	*Population rate* *Ethnicity* Indian White-British Pakistani Caribbean African Somali	Full Coverage at 12 mth % 89% 94* 93 (ref) 92* 91* 91* 88*	Full Coverage at 5 years % 60% 78* 73 (ref) 71* 67* 65* 60*
Hungerford et al., 2016 Effect of socioeconomic deprivation on uptake of measles, mumps and rubella vaccination in Liverpool, UK over 16 years: a longitudinal….	72 351	24 mths	UK (Liverpool) 1995-2012	A longitudinal ecological study	Population rate 2012 *Gender* Boys Girls *Deprivation* SIMD 1 and 2 (Highest) 3 4 5	No MMR1 % 93.4 (ref) 1.02* (ref) 1.12 1.26* 1.70*	No MMR2 % 90.3 (ref) 1.03* (ref) 1·02 1·06 1·36
Scottish Information Services Division, 2016	57 054 56 844	12 months	UK (Scotland) 2015	Total Population Statistics from Scottish Immunisation and Recall System (SIRS)	*Deprivation* SIMD 2012 Quintile 1 (Lowest) 2 2 4 5	MMR % 94.0* 94.9* 95.7 96.8 96.2(ref)	HiB/MenC % 94.6* 95.1 95.6 95.7 95.9(ref)

School age vaccinations

In eleven of the fifteen studies identified that reported on school age vaccinations, the outcome measure was initiated or completed HPV-vaccination in 11-13 year-old girls; four studies focused on the second MMR vaccination in both genders using wider age spans.

Socio-Economic Status

In Belgium 14 year olds from low SES families, categorized by income as well as education, had lower uptake of MMR and Hepatitis B boosters (Vandermeulen, 2008). In Denmark, girls in families with higher income were more often vaccinated with HPV vaccine than those with low SES, and a similar pattern was described in Scotland (Sink, 2014), while in England, the Netherlands and Norway vaccination patterns for HPV were found to be more equitable.

Migrants/minorities

In Belgium 14 year olds with parents born outside of Europe had much lower vaccination rates of Hepatitis B and MMR boosters (Vandermeulen, 2008), than children with parents born in Europe; in contrast to very similar vaccination rates of MMR2 in the Netherlands (van der Wal et al, 2005). In Denmark the uptake of the MMR booster was lower in refugee children compared with children from the Danish born population (Möller et al, 2016), and the uptake of HPV vaccination was much lower in refugee girls (Moller et al, 2016) than in the native population. Danish-born girls with foreign-born parents had lower rates of vaccination and have also been reported to have lower rates of HPV infection compared with the majority population (Widgren et al, 2011; Slattelid-Schreiber et al, 2015), and a similar pattern was described also in children in minority populations in England (Fisher et al, 2014; Spencer et al, 2014).

Table 8. Systematic review of school age vaccination rates in the EU/EES countries.

Authors Publication Year Title	N	Age	Location and Year of Data Collection	Study Design and source of data	Exposure	Outcome	
Vandermeulen et al., 2008 Vaccination Coverage in 14-year-old Adolescents: Documentation, Timeliness, and sociodemographic Determinants.	1344	14 yrs	Belgium (Flanders) 2005	Cross-sectional survey. Vaccination documents		MMR2	HBV
					Civil status	*%*	*%*
					Two-parent family	85.5 (ref)	76.5 (ref)
					Single divorced parent	72.0 *	70.2
					Single unmarried parent	83.3	83.3
					Maternal Ethnicity		
					Belgian	86.6 (ref)	77.7 (ref)
					European	81.9	75.9
					Non-European	51.5 *	52.6
					Monthly family income		
					<800	62.5 (ref)	7.5 (ref)
					800-1500	65.9	70.5
					1500-2000	83.7*	77.5 *
					2000-3000	86.3 *	78.2 *
					> 3000	89.1 *	77.8 *
Widgren, Simonsen, Valentiner-Branth, & Molbak, 2011 Uptake of the human papillomavirus-vaccination within the free-of-charge childhood vaccination programme…	33 838	12-13 yrs	Denmark 2009	National Register study		HPV initiation	
					Origin	%	
					Two Danish-born parents	85(ref)	
					One Danish-born parent	78*	
					Two foreign-born parents	80	
					Girl born in EU/EFTA country	68*	
					Other	76*	
					Urban/rural (population density)	No differences	
Moller, Hjern, Andersen, & Norredam, 2016 Differences in uptake of …	116 907	12 yrs	Denmark (2005-2012)	National Register cohort study		MMR2	
					Origin of children	%	
					Danish-born	68(ref)	
					refugees	63 *	
Moller, Kristiansen, & Norredam, 2016 Human papillomavirus immunization uptake among girls with a refugee background compared with Danish-born girls: a national register-based cohort study	22 848	12-15 yrs	Denmark (2009-2012)	National Register study		HPV	
						OR	
					Danish- born	(ref)	
					refugee	0.44 *	
					Predictors of uptake among (ref)ugees		
					Legal status		
					Asylum seekers	(ref)	
					Quota- (ref)ugees	0.79	
					Income (Danish KR)		
					< 91 000	(ref)	
					91 000- 103 000	1.85 *	
					103 000 – 118 000	2.14 *	
					>118 000	1.62 *	

Slattelid Schreiber, Juul, Dehlendorff, & Kjaer, 2015 Socioeconomic predictors of human papillomavirus vaccination among girls in the Danish childhood immunization program	66 986	12-15 yrs	Denmark (2009-2012)	National Register study	*Girl's ethnicity* Danish Descendant of foreign-born Foreign-born *Mother's education* Higher Vocational Basic *Mother's disposable income* High Middle Low	HPV completion 84.1(ref) 78.7* 75.3* 84.1(ref) 84.6* 80.2* 83.8(ref) 85.3* 81.7*
Hequet & Rouzier, 2017	1,496 ,933 girls	10-19 yrs	France (Ile de France) 2011-2013		*8 "departements"*	Percentage vaccinated with HPV at least once varied between 15.7% and 22.6%, which was not explained by SES factors of the population. Areas with a higher percentage of foreign-born had lower vaccination rates.
Poethko-Muller, Buttmann-Schweiger, & Ki, 2014 HPV vaccination coverage in German girls. Results of the KiGGS study	2 229 girls	12-17 yrs	Germany (KIGGS) 2009-2012	National Health survey	*Social status* Lower Middle Higher *Residence* East West	Complete HPV % 41.0 * 41.0 * 32.1 * 52.3 * 37.5 *
van der Wal, Diepenmaat, Pel, & Hirasing, 2005 Vaccination rates in a multicultural population	57 83 2	5-12 yrs	Netherlands (Amsterdam) 2003	National Register study	*Gender* Boy Girl *SES of the neighborhood* Very high High Low Very Low *Mother's country of birth* Netherlands Suriname Morocco Turkey	MMR2 % 94.0 93.8 94.1 94.0 94.5 92.0 95.8 95.5 97.3 97.0
Rondy, van Lier, van de Kassteele, Rust, & de Melker, 2010	381 869	13-16 yrs	Netherlands 2009	National Register study	*Country of birth of parents* The Netherlands Morocco Surinam	HPV % 51.8 (ref) 24.0 * 44.2 *

Determinants for HPV vaccine uptake in the Netherlands: A multilevel study					Turkey Other *Socioeconomic Status* High SES High average SES Low average SES Low SES	37.6 * 44.9 * 53.1 (ref) 50.7 * 49.4 * 46.9 *
Feiring et al., 2015 Do parental education and income matter? A nationwide register-based study on HPV vaccine uptake in the school-based immunisation programme in Norway	91 40 5 girls	12-13 yrs	Norway 2009-2013	National Register study	*Maternal education* <10 years 11-12 years 13-14 years 14-17 years 18 + years Paternal income (Quintile) 1 (Lowest) 2 3 4 5	HPV-initiation % 78.4* 77.6 79.0(ref) 78.0 76.7* 76.5 (ref) 78.5 79.3* 78.7* 78.9*
Hansen, Campbell, Burger, & Nygard, 2015 Correlates of HPV vaccine uptake in school-based routine vaccination of preadolescent girls in Norway: A register-based study of 90,000 girls and their parents	90 84 2 girls	12-13 yrs	Norway 2009-2013	National Register study	*Maternal education* <10 years 11-12 years 13-14 years 14-17 years 18 + years *Paternal income (in ncr)* <200,000 200,000–349,999 350,000–499,999 500,000–699,999 >700,000	HPV-initiation % 78.4 (ref) 77.6 79.0 78.0 76.7* 72.6* 77.5 78.5 (ref) 79.3 78.8
Fisher, Audrey, Mytton, Hickman, & Trotter, 2014 Examining inequalities in the uptake of the school-based HPV vaccination programme in England: a retrospective cohort study.	14 282 girls	12-13 yrs	UK (South - western England) 2008-2011	Total population study based on medical records	*Ethnicity* White British Mixed ethnicity Asian or British Asian Black or British Black Chinese and other Not stated *Deprivation quintile* 1 (Lowest) 2 3 4 5	HPV completion % 93.1 (ref) 93.7 92.3 * 90.4 * 90.1 * 90.4 * 93.1 (ref) 93.7 91.1 * 91.9* 93.2
Spencer, Roberts, Brabin, Patnick, & Verma, 2014	56 32 4 girls	12-13 yrs	UK (North west England) 2008-9	Total population study based on medical records	*Population rate* *Ethnicity* White British Mixed ethnicity	HPV initiation 82.4% OR (ref) 0.73

Sociodemographic factors predicting mother's cervical screening and daughter's HPV vaccination uptake					Asian Black Other *Deprivation quintile* 1 (Lowest) 2 3 4 5	0.90* 0.85* 0.65* 1.09 1.12* 1.03 1.05 (ref)
Sinka et al., 2014 Achieving high and equitable coverage of adolescent HPV vaccine in Scotland	86 769 girls	12-13 yrs	UK (Scotland) 2008-2011	National Register study	*Deprivation* SIMD 2012 Quintile 1 (Lowest) 2 3 4 5	HPV Dose 3 2011 % 76.0 80.1* 81.1* 84.0* 81.0*
Scottish Information Services Division, 2016	25 585 (S2) 2610 4 (S3)	11-13 ýrs	UK (Scotland)	National Register study	*Deprivation* SIMD 2012 Quintile 1 (Lowest) 2 2 4 5	HPV dose 2 % 82.7 (ref) 84.8* 86.4* 88.7* 89.8*

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Table 7

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Access to health care and vaccinations among Roma Children

Four studies were identified in the two systematic reviews that focused specifically on the Roma population. In the largest and most comprehensive of these studies Duval et al (2016) analysed data on 7072 Roma and 1161 non-Roma children up to six years of age from the Roma regional survey, which was carried out in 12 countries of Central and South-East Europe. As Table 9 shows, the overall gap between the Roma and the non-Roma children was about 20% for DPT and Measles vaccinations., Considerable differences can be seen between the MOCHA countries, Slovakia and Croatia having the lowest gap of vaccination coverage between Roma children and non-Roma children; and Romania and the Czech Republic having largest gap between children in Roma and the non-Roma populations. Adjusting analyses for socio-economic conditions attenuated these findings, but significant differences remained.

Table 9. Gap between vaccination for DPT and MCI in Roma and non-Roma populations in 2011 (Duval et al, 2016). Countries in bold are MOCHA countries.

	DPT %	MCI %
Albania	19.3	13.0
Bosnia and Herzegovina	33.9	35.7
Bulgaria	**21.5**	**17.1**
Croatia	**9.6**	**8.3**
Czech Republic	**25.6**	**28.0**
Hungary	**11.4**	**14.0**
Macedonia	15.5	12.5
Moldova	15.1	13.9
Montenegro	19.1	21.5
Romania	**25.7**	**30.1**
Serbia	**19.8**	**13.3**
Slovakia	**7.6**	**6.3**
All countries	20.4	19.7

A Polish vaccination campaign observed that only around 50% of the Roma children were fully vaccinated according to the national vaccination schedule. One important reason for not being vaccinated was that 14 % of the Roma children were not registered in the Polish population register, and thus had no access to the Polish health care system (Stefanoff et al, 2009). A study based on vaccination records in Slovenia showed that younger birth cohorts of Roma children had better coverage then older birth cohorts, but that vaccine coverage was considerably lower than of the general Slovenian population (Kraigher et al, 2006). Romero & Tartas (2008) investigated patterns of use of medical care of Roma children in the city of Logrono, Spain. They described a higher use of

emergency services compared with the Spanish majority population, but a lower use of preventive health services.

References for studies of Roma children in the systematic reviews

Duval, L., Wolff, F. C., McKee, M., & Roberts, B. (2016). The Roma vaccination gap: Evidence from twelve countries in Central and South-East Europe. *Vaccine, 34*(46), 5524-5530.

Kraigher, A., Vidovic, M., Kustec, T., & Skaza, A. (2006). Vaccination coverage in hard to reach Roma children in Slovenia. *Coll Antropol, 30*(4), 789-794.

Romero, M. A., & Tartas, A. G. (2008). Influencia del grupo étnico en el uso de los servicios. *Revista Pediatría de Atención Primaria*.

Stefanoff, P., Orikova, H., Rogalska, J., Kazanowska-Zielinska, E., & Slodzinski, J. (2010). Mass immunisation campaign in a Roma community created opportunity to estimate its size and measles vaccination uptake, Poland 2009. *European Surveillance, 33*, 16-21.

3. A study of quality indicators of primary care for children in eight MOCHA countries based on administrative data.

Five indicators of quality of primary care for children were defined in administrative data from health care services. The rationale for these indicators is presented in the introduction to this report (p 23-26). Indicators of preventive health care and early childhood were given priority in line with the WHO social determinants of health agenda [12].

There were three indicators of preventive care during early childhood:

1. Percentage of population vaccinated before 2 years of age with at least one shot of Measles containing vaccine (MCV).
2. Age at operation for Cryptorchidism (in those operated 0-17 years of age). a. Percentage operated before 12 months of age. b. Percentage operated before 3 years of age.
3. Age at first diagnosis of Autism spectrum disorder in native born children according to diagnosis in specialized/hospital care.

Two indicators of curative care were based two of the most common Ambulatory care–sensitive conditions [56] in children defined by the US Agency for Healthcare Research and Quality (AHRQ):

1. Yearly incidence of a. Hospital admissions and b. Emergency room care with a diagnosis of viral or unspecific gastroenteritis in native-born 1-5 year olds.
2. Yearly incidence of a. Hospital admissions and b. Emergency room care with an asthma diagnosis in 6-15 year olds.

The exact definitions of the indicators used in this research are presented in the Appendix.

Study data:

Data was searched for within the MOCHA community and associated networks. Data to be included in the analysis should preferably be nationally representative, but data on regional populations were also accepted when national data were not available. To be included in the analysis, data should include at least one link to an indicator of SES, migrant/ethnicity or urban/rural residency.

The following countries could provide data and were thus included in the study:

Austria:

Tables of hospital admissions for asthma and gastroenteritis and operation for cryptorchidism in 2015

were based on data from STATcube – Statistische Datenbank von Statistik Austria, https://www.statistik.at/.

Age at diagnosis of autism came from patient records at Autism Centre, Zentrum für Kommunikation und Sprache, University of Linz.

Denmark:

Data for tables on MMR on a random sample of the total population of Danish children born 2005-2008 (N=3 396) came from the Danish Vaccination Register individually linked to data on income of the household at the year of birth of the child from Statistics Denmark. Indicators based on hospital care were tabulated with data from the Danish Patient Register [70] on the total national population in 2010 (cryptorchidism, asthma) and 2014 (gastroenteritis). These indicators were individually linked to data on disposable income of the household, divided into quartiles of the total Danish population. Migrant/ethnicity categories were based on parental country of birth and categorized into a. Two Danish-born parents. b One foreign-born and one Danish-born parent. c. Two foreign-born parents, mother born in Europe. d. Two foreign-born parents, mother born outside Europe.

Finland:

Vaccination data covered all children born in Finland in 2013 according to the Finnish Medical Birth Register and the data on vaccinations before the age of 2 years was taken from the Vaccination Register, which is a part of the Primary Health Care Register. Indicators based on hospital admissions and operation for cryptorchidism were tabulated with data from the Finnish Patient Register [71] on the total national population of 2001 (cryptorchidism) and 2001-2010 (gastroenteritis and asthma). These indicators were individually linked to data on parental education from the Finnish Medical Birth Register, categorised into four categories; No more than upper secondary, lowest tertiary, lower degree level tertiary, higher degree tertiary. Migrant categories were defined by maternal country of birth and citizenshiop into: a. Finnish-born, Finnish citizen, b. Born elsewhere, Finnish citizen. c. Finnish-born, Citizen elsewhere, d. Foreign-born, citizenship elsewhere. Regional resiedency was defined as: a. Urban. b. semiurban. c. rural.

Iceland:

Data in Iceland on vaccinations are based on electronic records in primary care that feed information in virtual time into the national health information system under the responsibility of the Directorate of Health. This data were linked individually to social and demographic information from Statistics Iceland, which gave us details about SES, migrant status and rural/urban settings. This information was then decoded of personal identifiable information and made accessible in a portal in the University of Iceland, established to secure privacy of data. The analysis was approved by National Bioethics Committee (17-044), and the Icelandic Data Protection Authority (2017010030; 11 May 2017).

Ireland:

Tables of MMR1 uptake at 24 months were created with data from the Health Protection Surveillance Centre www.hpsc.ie . Tables of hospital admissions were created from datasets from the Hospital InPatient Enquiry (HIPE) via Health Atlas www.healthatlasireland.ie . The health care data and census data (courtesy of Central Statistics Office www.cso.ie) was linked geographically to 27 local health offices with defined geographic areas. Each area was given a Deprivation score on an eight-point scale from extremely affluent to the extremely disadvantaged, derived from Health Atlas, www.healthatlasireland.ie, ultimately from Haase-Pratschke (HP) Deprivation Index www.trutzhaase.eu. These categories were transformed from eight to five categories by the merger of the categories extremely and very disadvantaged, marginally below and marginally above and extremely and very affluent.

Spain:

Vaccinations from 2014-2015 were provided by the Statistical office of the Catalan Health Service. The socio-economic indicator is based on 368 small local areas with a primary care centre of reference, each with a population between 5000 and 25000 people. 342 areas were included in this study. The indicator is constructed by the Observatory of health in Catalonia http://observatorisalut.gencat.cat/ca/inici/ based on income,; % of manual workers; % of people with low level of education; premature mortality; and avoidable hospitalization.

Sweden:

Data on the uptake of DPT and MMR at the age of two was collected from the database of statistics of Child Health Care in the total population of children in Uppsala and örebro counties in 2011 [72]. Operation for Cryptorchidism and admissions for asthma and gastroenteritis were identified in the National Patient Register [73] of 2013, , which includes inpatient overnight stays, day care as well as outpatient specialised care. Admissions were defined as overnight stays. Age at first diagnosis of autism was identified in birth cohorts 2001-2003 in this same register, followed up until 2013. All indicators were linked individually to socio-economic indicators of the households (disposable income, family type, parental country of birth and residency). For vaccination, this information was from 2010, for gastroenteritis, asthma and cryptorchidism, the information was from 2012, and for autism, the year before the birth of the child. SES was measured as quintiles of disposable income of the household in the population in the study. Migrant categories were based on parental country of birth and categorised as a. Two Swedish-born parents, b One foreign-born and one Swedish-born parent. c. Two foreign-born parents, mother born in Europe, North America, Australia or New Zeeland. d. Two foreign-born parents, mother born outside Europe, North America, Australia or New Zeeland.

United Kingdom:

Tables of uptake of MMR at 2 years of age were based on data covering 2015 provided the Royal College of General Practitioners Research and Surveillance Centre (RCGP RSC) sentinel network in England. In 2015, the network included a little over a million patients registered in 107 participating general practitioner (GP) practices (www.rcgp.org.uk/rsc). The RCGP RSC is a representative network, having only small differences with the national population.

Tables on hospital admissions in England were taken from Hospital Episode Statistics Admitted Patient Care and includes day care as well night stays (http://content.digital.nhs.uk/hes). All English data was linked geographically to the English Index of Multiple Deprivation (IMD) at surgery. The IMD scores lower-layer super output areas (small area census geographies population between 1000 and 3000, average 1500 people) on the basis of seven domains of deprivation: income, employment, health, education, barriers to housing & services, crime and living environment. Data on self-reported ethnicity was available for around one third of all hospital admissions into four categories (White, Black, Asian, Mixed). Regional categories (Urban, rural (town and fringe), rural (village and hamlets) was based on the Rural-Urban Classification for Small Area Geographies http://www.gov.uk/government/collections/rural-urban-classification . In this study the IMD deciles were transformed into quintiles

A summary of the social indicators in the study

The available indicators of SES in this study were diverse, including family based indicators of income, education, family type and paternal profession in the Nordic countries, a small area based indicator in Spain and the UK, and an indicator based on large areas in Ireland. This can be seen in more detail in Table 10.

Indicators for migrant status/ethnicity were less often available. Sweden, Denmark and Iceland based these on parental country of birth, and in the UK they were based on self-reported ethnicity . Regional indicators were more uniform, expressing degrees of urbanicity in different definitions in five of the participating countries.

Table 10. Socio-economic indicators in the collected data

	AU	DK	FI	IC	IR	SP	SW	UK
SES								
Family income		■		■			■	
Parental education			■				■	
Small area						■		■
Large area	■				■			
Parental age		■		■			■	
Family situation		■		■				
Migrants/Ethnicity								
Self reported ethnicity								■
Parental country of birth		■		■			■	
Regional								
Urbanicity		■		■			■	
Geographic	■							

Results:

Vaccinations

Data from comprehensive national registers with individual data were available from Finland, Iceland and Denmark (random sample) and complete national data with area based linkage from Ireland. Individually linked regional total population data was available from Sweden, and regional small area based population data from Spain (Catalonia). UK data was provided from 1200 nationally representative English general practices. The Swedish and Danish data was older (2010-2011) than the more recent data provided by the other countries. Regional data and data on ethnicity were only available from three countries (Sweden, Finland and Iceland) and is thus not tabulated.

Table 11 shows the vaccination coverage of Measles containing vaccine stratified by gender and SES. There were minimal differences by gender, but girls were slightly more often vaccinated in England (UK) and Denmark, and boys slightly more often Finland. In Finland and Ireland there were no clear differences between SES groups; while in Catalonia(Spain) uptake of MMR was lower in children in the most privileged areas. In Denmark there was a sequential social gradient by family income with children in families with lower incomes having lower vaccination uptake, with an uptake as low as 76% in the lowest quartile. In England (UK), children living in the areas with the lowest IMD quintile had a considerably lower uptake of MMR (84%) compared to the four upper quintiles, with the regions of Örebro and Uppsala in Sweden and Iceland having a somewhat similar pattern on a smaller scale.

Table 11. Vaccine coverage of Measles containing vaccine at 2 years of age by gender and SES.

	DK	FI	IR	IC	SP (CA)	SW (Ö/U)	UK(EN)
Year	2010	2015	2016	2015	2015-16	2011	2015
N	3 396	58 255	17 028	3 917	202 204	16 084	16 533
	%	%	%	%	%	%	%
Gender							
Boys	81.5	93.0	92.2			94.3	90.3
Girls	82.8	92.5	92.2			94.3	91.8
SES	Income	Education	Large Area	Income	Small Area	Income	Small Area
1=Lowest	76.5	92.7	91.6	88.2	94.9	91.7	84.5
2	81.4	94.2	93.6	90.8	95.4	95.8	94.0
3	88.0	94.3	92.8	94.1	91.9	96.5	96.7
4	90.3	94.1	92.6	94.5	92.4	96.1	94.0
5=Highest		93.0	88.6	94.3	90.8	96.1	93.5

Age at operation for cryptorchidism

Six countries provided data on age at operation for cryptorchidism. There were very clear indications in that the guidelines mentioned above, recommending operation during the first 12 months of life, have been implemented poorly in all the participating countries. Denmark and Finland had the highest proportion operated according to the guidelines (21% and 25%), with the UK having the highest proportion operated before three years of age (78%). The only country where there is a consistent pattern of later operation for disadvantaged children (by family income as well as parental country of birth) is Sweden. There were minimal regional differences between urban and rural areas, again with Sweden as the exception with children in rural areas more often being operated before three years of age than those living in the larger cities.

Table 12. Age at operation for Cryptorchidism, in children operated at 0-17 years of age.

	Austria		Denmark		Finland		Sweden		UK (England)	
Year	2014		2014		born 2001, 0-15 yrs		2013		2013	
N	564		1 067		630		913		5 914	
Age at operation	<1 yr	<3ys	<1 yr	<3ys	<1 yr	<3ys	<1 yr	<3ys	<1 yr	<3ys
	%	%	%	%	%	%	%	%	%	%
All	*3.8*	*47.0*	*21.4*	*35.6*	*4.8*	*46.6*	*2.8*	*51.0*	8.6	47.7
SES			Income		Education		Income		Small area	
1=Lowest			18.9	32.2	6.5	51.0	2.2	42.7	9.4	49.3
2			17.5	34.6	4.9	47.1	2.4	43.2	8.1	47.8
3			26.4	39.9	3.6	42.0	4.3	50.6	7.7	46.6
4			20.2	33.8	4.8	46.8	3.7	55.0	8.2	46.0
5=Highest			26.2	38.3			2.2	52.1	9.0	47.9
Migrants/ Ethnicity			Maternal country of birth		Maternal country of birth		Parental country of birth		Self-reported ethnicity	
Cat 1			21.6	35.6	4.9	45.5	2.9	52.0	8.0	45.2
Cat 2			23.6	37.5	0.0	60.0	3.8	50.0	5.5	42.9
Cat 3			34.8	43.5	no case	no case	3.4	48.2	9.0	58.3
Cat 4			15.7	33.3	4.2	66.7	1.1	46.1	7.5	50.0
Cat 5									8.4	55.0
Regional										
Cat 1	5.5	47.5	28.1	43.2	5.1	46.7	3.7	46.4	8.6	48.8
Cat 2	3.4	46.9	15.5	25.6	4.8	46.4	1.7	53.3	10.8	45.2
Cat 3			19.3	33.9	4.0	46.5	3.7	60.4	6.3	39.0

Age at diagnosis of autism (F84.0)

There were only three countries that provided data on age at the first diagnosis of autism (defined as ICD-10 code F84.0) in the available patient databases, and only two, Finland and Sweden, with social stratification. The long follow-up time needed for this indicator implies that this information reflects clinical practices that may have changed considerably in recent years. There were no clear differences between social groups in Sweden and Finland.

Table 13. Age at first diagnosis of autism.

	Austria	Finland	Sweden
N	45	4 555	2 278
Year	2016	Born 2001-2010, followed until 2015	2000-2004, followed until 2013
	Mean age (yrs)	Mean age (yrs)	Mean age (yrs)
Gender			
Boys	3.2	7.8	7.4
Girls	3.2	7.8	7.4
SES		Education	Income
1=Lowest		7.8	7.3
2		8.2	7.5
3		7.5	7.7
4		7.9	7.5
5=Highest			7.4

Ambulatory care-sensitive conditions: 1. Hospital care for viral gastroenteritis in preschool children.

Data on hospital admissions for viral gastroenteritis, as an ambulatory care-sensitive indicator of acute care in primary care, was provided by six countries, with five that provided data stratified by a SES indicator. Denmark had the highest incidence of hospital admissions, followed by Austria and the UK (England). There was a graded social pattern in Finland, Ireland, Sweden and England, with socially disadvantaged children having the highest incidences of hospital admissions. For Sweden, this gradient also included children of foreign-born parents compared with Swedish-born parents. Denmark was the exception here, with high admission rates and relatively small differences between income categories.

Table 14. Incidence of hospital admissions because of viral gastroenteritis, 1-5 year olds.

	AU	DK	FI	IR	SW	UK (EN)
N		326 834	295 410	331 515	546 596	3 413 634
National Rota-virus vaccine policy	No	No	Since 2009	Since april 2016	In 2/21 counties since 2014	Since 2013
Year		2010	2002-2015, per year	2016	2013	2013
	1/1000	1/1000	1/1000	1/1000	1/1000	1/1000
Gender						
Boys	10.1	14.0	4.9	6.5	4	9.3
Girls	9.4	12.7	5.3	6.2	3.8	8.6
SES		Income	Education	Big Area	Income	Small Area
1=Lowest		13.9	5.4	10.1	5.1	11.0
2		13.9	5.8	8.9	4.4	9.5
3		13.4	4.7	9.1	4.2	8.5
4		13.1	4.2	3.6	3.2	7.8
5=Highest				2.9	2.6	6.5
Migrant		Maternal country of birth	Maternal country of birth		Parental country of birth	Self-reported ethnicity
Cat 1		13.2	5.2		3.7	7.0
Cat 2		10.4	5.9		3.4	6.7
Cat 3		16.1	2.5		4.6	10.1
Cat 4			4.9		5	4.6
Cat 5						
Regional						
Cat 1	5.8		4.9		3.8	9.0
Cat 2	8.9		5.1		4.1	8.4
Cat 3	9.2		6.1		3.9	8.7
Cat 4	14.4					

Of the seven countries, the very youngest cohorts from Finland (vaccination since 2009) and the UK (since 2013) expect to have been vaccinated against rotavirus as infants. Rotavirus is the main cause of hospital admissions for gastroenteritis in high income countries [74].

Sweden was the only country that provided outpatient data om emergency care in hospitals (Table 15). As Table 15 shows, the incidence here was about three times that of inpatient admissions, but with a very similar social pattern.

Table 15. Incidence of hospital care, admissions and outpatient emergency room care for viral gastroenteritis in Sweden.

	Admission	Emergency room
N	546 596	546 596
Year	2013	2013
	1/1000	1/1000
Gender		
Boys	4	10.5
Girls	3.8	10.5
SES	Income	Income
1=Lowest	5.1	13.8
2	4.4	12.8
3	4.2	11.5
4	3.2	8.3
5=Highest	2.6	6
Migrant		
Cat 1	3.7	9.5
Cat 2	3.4	9.4
Cat 3	4.6	18.3
Cat 4	5	14.6
Regional		
Cat 1	3.8	8.3
Cat 2	4.1	13.5
Cat 3	3.9	10.4

Ambulatory care-sensitive conditions: 2. Hospital care for asthma in school children.

Data on hospital admissions for asthma, as an ambulatory care-sensitive condition for chronic conditions in primary care, were provided by six countries, with five providing data with stratified by a SES indicator. Of these six countries, four participated in the third wave of the international ISAAC study 200-2003 [75]. Children in England had one of the highest prevalence of severe asthma (at least four episodes of asthma attacks during the last year) in that study and had prevalences that were considerably higher than the other countries in this study, at both 6-7 and 13-14 years of age.

Table 16. Incidence of hospital admissions with a diagnosis of asthma in the age group 6-15 years.

	Austria	Denmark	Finland	Ireland	Sweden	U.K. (Eng)
ISAAC 6-7 year olds, %[1]	2.5				4.2	10.7
ISAAC 13-14 year olds, %[1]	6.7		5.1		3.4	10.5
N	828 654	667 648	520 546	675 037	828 537	5 980 824
Year	2014	2010	2006-2015, per year	2016	2013	2013
	1/1000	1/1000	1/1000	1/1000	1/1000	1/1000
Gender						
Boys	0.8	2.3	0.9	2.6	0.6	7.6
Girls	0.5	1.7	0.5	2.0	0.4	5.6
SES		Income	Education	Large Area	Income	Small Area
1=Lowest		2.0	0.8	2.8	0.8	8.7
2		2.1	0.8	2.0	0.6	7.2
3		1.9	0.6	2.3	0.7	6.3
4		1.9	0.5	1.2	0.5	5.4
5=Highest				2.4	0.3	4.7
Migrant		Maternal country of birth	Maternal country of birth		Parental country of birth	Self-reported ethnicity
Cat 1		1.9	0.8		0.5	4.6
Cat 2		1.5	1.0		0.5	2.2
Cat 3		2.7	0.0		0.6	1.7
Cat 4			0.4		0.6	1.7
Regional						
Cat 1			0.7		0.5	6.8
Cat 2			0.9		0.6	5.5
Cat 3			0.9		0.6	5.6

[1]=Prevalence of severe asthma in the third phase of the ISAAC study 2000-2003[75]

The incidence rates on admissions differed greatly between countries, with a tenfold difference between the highest rates (England) and the lowest (Sweden). Despite these large differences in incidence rates, the gender patterns and the social patterns were quite similar between countries, with children in more disadvantaged families/areas having higher rates of admissions (Table 16).

When incidence rates are stratified by age groups (Table 17), the increased rates in England are particularly high in relative terms for the 13-15 year olds, the difference between the countries with the lowest incidences (Sweden and Austria) and the UK is almost 20-fold.

Table 17. Incidence of hospital admissions with a diagnosis of asthma in the age group 6-15 years.

	Austria		Denmark		Sweden		United Kingdom (England)	
Year	2014		2010		2013		2013	
	1/1000		1/1000		1/1000		1/1000	
Age	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
6-8 yrs	1	0.6	3.3	2.1	0.8	0.6	9.7	6
9-12 yrs	0.8	0.4	2.4	1.3	0.7	0.5	9	6
13-15 yrs	0.5	0.5	1.2	1.7	0.5	0.4	8.8	8.8
All	*0.8*	*0.5*	*2.3*	*1.7*	*0.6*	*0.5*	*9.2*	*6.9*

4. Discussion

This report has presented results from systematic reviews of equity patterns in utilization of primary care and vaccinations for children in countries participating in the MOCHA project. It also includes a pioneering study of inequity patterns of five quality indicators of primary care for children in administrative data provided by eight of the MOCHA countries. The overall picture is quite diverse, there are considerable differences in equity between countries, but also to a certain extent within the same country when patterns for preventive and curative care are compared, suggesting that quality of care in preventive and curative care should be analysed separately. The information presented describes the situation in north, central, south and west Europe, while the available information about the newer member states in Eastern Europe was limited to studies of the Roma population. In the following discussion, equity patterns are synthesized in relation to the theory theoretical framework of factors that determine equity, discussed in the introduction and summarised in Figure 1.

The wealth of nations and the distribution of wealth within nations

The analysis of the importance of wealth in the society for inequity patterns of health care use was greatly hampered by the lack of information about the least affluent MOCHA countries (See Table 1). There was, however, some data on health care utilisation in Spain and Greece, two of the moderately less affluent countries in southern Europe. Multiple studies in Spain indicated a relatively high degree of equity compared to the studies from Greece, where studies showed more inequity in health care use and uptake of vaccinations.

The distribution of wealth within societies, as measured by the Gini-coefficient in Table 1, seems to demonstrate that the UK has high degrees of inequity in distribution of wealth, but our research shows that this doesn't necessarily lead to high degrees of inequity in access to health care for children. The large difference between the richest and poorest households is coupled with investments in health care based on proportionate universalism, as was seen in the UK during 2001- 2011, a fairly equitable access to care can be achieved [76,77] . Thus, neither the total resources available in a society nor the distribution of these resources between social groups, seem to be key determinants of equity in access to primary care in Europe. This is in line with evidence that primary care has a potential to buffer the effects of social inequalities by facilitating access to socially disadvantaged groups at the general population level, also in less affluent countries [78].

The organisation of primary health care

Primary health care organisations that are based on the professional non-hierarchical model (See Table 2), those of Austria, Belgium, France and Germany all provide a considerable freedom for primary care physicians to choose where to set up their practice within in the primary care organisation; and there

is comparatively limited influence of the national or regional state [21]. The literature reviews in this report show that this type of health care organisation is associated with considerable regional differences in access to health care. For Austria and Germany, there were also indications of considerable socio-economic differences in uptake of preventive health services and for Germany also in access to care.

Health care reform is currently underway in many European countries with a National Health Service, such as the UK, Spain and Sweden [79] . These reforms have some common features including increases in the proportion of private providers, application of market-based mechanisms including New Public Management (NPM), the promotion of a patient choice agenda and changes to resource allocation systems. These changes also include facilitation of the establishment of new private outpatient practices reimbursed by public funds at locations chosen by the health care professionals themselves. Thus, the reforms are moving these primary care models closer to the professional non-hierarchical model. As predicted by the situation in countries with this model, studies in the adult population have shown that such changes lead to increased inequity in utilisation of primary care [80,81]. Consequences of these changes for children's access to care in different social groups should routinely be monitored.

The strength of primary care

Kringos et al [22] categorised primary care models of EU member states into weak, intermediate and strong according to seven quality criteria, based on surveys in the adult population (See Table 2). Of the states described to have "strong" primary care models in this study, some (UK, Spain, Finland, the Netherlands) seem to have quite equitable models of primary care also for children, but there were also indications that some "strong" countries such as Denmark (in terms of vaccinations and other preventive health) and Belgium (in terms of school age vaccinations) seemed to be less equitable, at least for preventive health services. Thus, measures of quality of primary care for adults seem to be of limited use in predicting the equity of preventive health services for children.

In a study of differences in utilisation of primary care by educational strata in the adult population in nine MOCHA countries, Stribu et al [13] described Belgium and Germany as being less equitable than Norway and Netherlands. This pattern is somewhat corroborated also for children in our systematic reviews, with the exception of the comparatively high degree of equity in uptake of preschool vaccinations in Belgium.

GP vs Paediatrician.

In four countries: Austria, Greece, Spain and Germany, primary care paediatricians are the lead physicians in the primary care system. The studies reported from Spain seem to indicate an equitable

primary care model for children but there are indicators of a considerable degree of inequity in the literature reviews in the other three countries, in terms of health care utilisation as well as vaccinations. Germany is an interesting example, in that there are regional differences within the country. The former East Germany relies more on general practitioners as the principal primary care physicians for children, and the former West Germany relies more on paediatricians [82] . Uptake of vaccination rates were higher in the former East compared to the former West Germany, while the SES patterns for access to curative care were similar, suggesting that there are other factors than the lead practitioner in primary care that affect the quality of primary care for children, and equity of provision of care in this country.

Preventive health services

Reports of recent measles outbreaks in Europe [83], showed that marginalized populations with poor access to health care, such as the Roma and traveller populations, have been particularly susceptible to measles. This underlines the importance of equitable access to preventive health care. Preventive health is an important part of primary care models for children, and accordingly three of the five quality indicators in the data collected and both literature reviews had indicators with relevance to preventive health care for children.

Table 4 outlines the different ways that preventive health services for children can be organized . Six MOCHA countries: Belgium, Finland, Iceland, the Netherlands, Norway and Sweden incorporate a special organisation for preventive health for the youngest children in their primary care models, “well-baby clinics”. These clinics are built around child or public health nurses that follow the family from the neonatal period until school entry. In other countries preventive health services are more integrated into the regular primary care system, and often, but not always have physicians in a more prominent role. In these systems the care of the young children is often more fragmented between different health professionals. According to our literature reviews and the data collected in the study of proxy indicators, the six countries that have well-baby clinics all have quite equitable uptake of vaccination for pre-school children and (in Sweden) also use of other preventive services. In contrast, Denmark has more inequitable patterns of use of preventive health services and uptake of vaccines. This is despite the fact that it is a Scandinavian country with many contextual similarities with the other Scandinavian welfare-based societies, but where preventive health services for young children after the neonatal period are built around the physician (General practitioner).

At school age, vaccinations can be delivered within school health services or by the general primary care centre (as shown inTable 4). Our literature review indicates that in countries where school health

delivers vaccines, there tends to be a more equitable uptake of vaccines. In Belgium, for example, where vaccines in school age are delivered by the GP there is a high degree of inequity of provision, in contrast to the preschool population, where vaccines are delivered by specialised nurses in well-baby clinics and there is greater equity of provision among the different child population groups. This is particularly illuminating in terms of the importance of the organisation of preventive health services.

The four quality criteria for primary care suggested by Starfield [25]: access, longitudinally, comprehensiveness and coordination have not yet been used in studies of preventive health services for children. It seems likely, however, that well-baby clinics, where one nurse follows the family from the neonatal period until school entry, can provide care with better quality according to these criteria, compared with more fragmented models of preventive health where different interventions are delivered by different health professionals; i.e. home visiting by one nurse, vaccinations by a doctor, screening for vision and hearing problems by other professionals etc. Spain (Catalonia), Ireland and Scotland, countries/regions without well-baby clinics, however, also reported a high degree of equity in uptake of vaccines. Thus, it seems possible to provide preventive health services, or at least vaccine uptake, with a high degree of equity also when prevention is more integrated into the general primary care organization.

Previous research into interventions to improve access to preventive care for "hard to reach" populations have primarily focused on interventions that can be used within one specific primary health care model, for example the NHS model in the UK [84]. A recent review evaluated these interventions and found that complex, locally designed interventions demonstrated the best evidence for effectiveness in reducing inequalities in deprived, urban, ethnically diverse communities [84]. To some extent, these interventions create a model for preventive health that is similar to the well-baby clinic, as they include delivery of several preventive interventions on a platform with easy access and continuity in relation between caregiver and family. This suggests that taking a broader perspective might be beneficial in future developments in this field, where changes in the overarching primary care model, guided by the Starfield quality criteria of primary care, may be a more effective way to improve equity in vaccination uptake than to implement small scale interventions within the existing primary care model.

For age at operation of cryptorchidism, no country seemed to have successfully implemented the guidelines that recommend operation before 12 months of age. The UK and Denmark, countries with a preventive health service built around GPs, however, had a slightly higher compliance to the guidelines. One may speculate that a preventive health service system built around a physician may

be more effective when it comes to implementing screening procedures that demand medical participation.

Gender

Gender patterns were rarely the main focus of the studies reviewed and were quite often not reported at all, particularly for younger children. Some pertinent gender differences were found in studies of health care utilisation in adolescents, where girls were found to use more psychiatric care in Sweden and to visit GP:s more often in Norway and Spain, while patterns were more similar between adolescent boys and girls in use of paediatricians in Greece. Uptake of vaccinations was similar between genders. For both ambulatory-care sensitive conditions (asthma and gastroenteritis), boys were admitted to hospital more often than girls. In terms of asthma at least, this is likely to reflect differences in morbidity in asthma rather than difference in quality of the care received [85,86].

Migrants and minorities

The diverse criteria used to categorize migrant populations and ethnic minorities in the different data sources in this study greatly limits the possibility for meaningful comparison between countries. However, some notable patterns were identified. In a previous MOCHA report [1], Germany was identified as a country where entitlements for primary care for undocumented children are limited. Just as can be expected with such a policy, Wenner et al described a much higher use of emergency care by these children in Germany [87] . The previous MOCHA report [14] also point to the risk associated with providing health care for asylum seekers in parallel health care systems. Two studies of vaccination rates in Denmark, a country that provides care for asylum seekers in a parallel system, showed lower rates of vaccinations for pre-school as well as school children in refugee families[34,88].

Patterns were also diverse for studies of children from ethnic minority groups. In England, children in families with Indian ethnicity were reported to have higher uptake of preschool vaccinations compared with the majority population; while children in families with an African ethnicity tended to have lower rates. In Norway, schoolchildren in the indigenous Sami minority group showed a higher use of GP services, but lower use of school health compared with the majority population. In most studies, including the study of quality indicators in administrative data, however, patterns for children with a migrant background were similar to those to children in low SES families.

In the literature about health care for migrant and minority children, the importance of facilitating cross-cultural communication by using interpreters and providing appropriate training in cross-cultural issues is often emphasized [89]. There were no studies, however, in the literature review that evaluated this in relation to quality of care received. Thus, further studies are needed to evaluate these aspects

of primary care models for children in Europe. Such studies could potentially could use the PCAT, an instrument that includes this dimension of care [50].

In the systematic literature reviews, Roma children were reported to have lower uptake of vaccination in all countries where studies had been performed. This is a blunt example of the ”inversed care law”, since a number of studies show that Roma children in Europe are much more to be born with perinatal risk factors, such as preterm birth and low birth weight and in the pre-school age have a higher burden of infectious disorders than majority populations [90]. There were, however, interesting differences between countries regarding the magnitude of the gap between the Roma children and majority populations with regards to vaccination uptake. Particularly interesting is the difference between the comparatively low gap in Slovakia and the comparatively large gap in the Czech Republic, since these two countries were united into one state for many years. One factor that might explain the more favorable situation in Slovakia is the strong commitment of non-govermental organisations (NGO:s) there in improving the health care situation for the Roma [91].

Family type

The death of studies that reported outcomes by family type greatly limited the possibilities of drawing conclusion about equity patterns with regards to family type. Five studies, however, reported vaccination coverage stratified by family type. Germany, Spain and UK showed lower vaccination coverage for children living in single parent households, while the reported vaccination patterns from Sweden, Ireland and Austria were similar between lone and two parent household. A Swedish study also showed a two-fold increase in use of child and adolespect psychiatry in children in single parent families compared with two parent families, probably related to an increased needs of health care.

Acute care; viral gastroenteritis

The study of administrative data presented in Chapter 3 included viral gastroenteritis as a tracer condition for care for acute conditions in primary care. Viral gastroenteritis is a common acute disorder in preschool children because pre-schools and other day care centres are a common setting for transmission of these viruses [92]. Since day care attendance varies little by socio-economic status in northern Europe [93], major differences in incidence of viral gastroenteritis by socio-economic status seems unlikely [94]. A recent single longitudinal study from the UK even showed a reversed social gradient, with a lower occurrence of infectious intestinal disease in the socially disadvantaged [95]. The large majority of children with these disorders can be treated at home with oral rehydration and support from primary care services [96]. Thus, the clear social gradient found in hospital admission rates for viral gastroenteritis, and the outpatient care in the emergency ward in Sweden, suggests that

support to socially disadvantaged families in primary care for acute illness is not provided in relation to needs in any of the countries in the study.

Rotavirus is the main pathogen found in hospital admissions for gastrointestinal infections in high income countries [97], and a vaccine against this virus has recently being implemented in several European countries including Finland, UK, Ireland and parts of Sweden [98]. This vaccine can be expected to lower the incidence of hospital admissions for gastrointestinal disorders and may alter socioeconomic patterns, dependent on the social patterning of the uptake of the vaccine. Thus, future studies are needed that can evaluate the effect of this vaccine on equity patterns.

Care for chronic health conditions: asthma

Hospital admission for asthma in schoolchildren was included in our study as a tracer for primary care quality of chronic disorders. There was a tenfold difference in the incidence of asthma admissions between the countries studied, with the UK having the highest incidence and Sweden the lowest. Despite these large differences in incidence, the socio-economic pattern in Sweden, the UK and three of the other four countries were similar with children in low SES families having about a twofold higher incidence compared with the highest SES group. The only country with marginal differences between SES groups, Denmark, still has a twofold higher incidence in children in families with an origin in non-western countries compared to the majority population.

With the exception of a small subgroup of children with very severe asthma, school children with asthma should be able to live a normal life and stay out of hospital if they are properly treated in primary care [99]. A recent systematic review found a social gradient for childhood asthma in 63% of the studies reviewed [100]. Studies reporting socioeconomic differences in prevalence of asthma include studies from Sweden in preschool children [101] and 18 year olds [102], and a British study of wheezing in preschool children [103]. Hence, to provide equitable care for children with asthma in deprived neighbourhoods, resources need to be greater than in more affluent neighbourhoods, following the principle of proportionate universalism [104]. The results of our study suggest that no country provides the resources needed to achieve such vertical equity.

In the systematic literature review, only one study described consequences of chronic health conditions in children by social groups. In this Scottish study of asthma, a clear gradient of inequity was identified in terms of hospital admissions and school absence [105]. This study underlines the importance of practicing proportionate universalism for children with socially graded chronic disorders, like asthma.

Quality indicators of primary care for children in administrative data

This report has pioneered the use of ambulatory care sensitive conditions in the evaluation of primary care for children in Europe. The ambulatory care sensitive conditions have been developed as valid indicators in comparisons of quality of primary care between different providers within the same health care organisation [25]. When these indicators are used to compare different national health care organizations, as in this report, some major methodological problems arise. The incidence rates of hospital admissions are determined by a number of different factors in hospital care, such as the administrative context, clinical practice and infrastructure, for example the number of hospital beds [106].

The data on asthma and gastroenteritis admissions showed some general patterns. For example, the UK tended to have higher admission rates than other countries in our study. One explanation for these high rates could be the policy between 2004 and 2016 of penalising UK hospitals financially if patients spent more than four hours in the emergency department. In response to this policy, many hospitals set up assessment or observation units to avoid breaching the four hour waiting target. The patients in these observation units were counted as inpatient care in the administrative data from the UK used in our study. As a result, the patients with short stays in the hospital are included in admission rates in the UK– an artefact that is not present in the other countries in the study. It is possible that including outpatient care in the emergency ward in the measure of these indicators would reduce some of these problems in comparability between countries [107]. For differences between social groups, however, these confounding factors can be expected to be more random and the patterns more valid as quality measures.

In general, the social patterns of hospital admissions in this study were quite similar between countries, in contrast to the total incidence rates. More evaluative research is needed before these indicators can be used for meaningful cross-country comparisons of quality of primary care for children. A British study of adults has suggested that the quality of asthma treatment in primary care predicts hospital admissions [57]. Similar studies of children, with adequate adjustment for socio-economic indictors, are needed to validate asthma admissions and other hospital based indicators as a quality indicator of primary care.

Age at diagnosis of autism was created as an indicator of timely identification of children with developmental problems in preventive health services. However, it is a problematic indicator. Clinical practices in detection of autism has evolved rapidly in recent decades, which makes the long follow-

up time needed to calculate this measure problematic. Another technical problem is that it demands a personal identifier in the administrative data to identify the first diagnosis, which limits the number of countries able to report their data. Hence, it is probably an indicator best suited for use in data from patient records at centres for autism.

Age at operation for cryptorchidism is a new and interesting indicator for the identification and treatment of congenital malformations in preventive health services. Because this indicator can be created with data from hospital discharge databases, without linkage to the population, the data it is more accessible than the ambulatory-care sensitive conditions. The presence of acquired cryptorchidism with such great variation between studies, however, makes the proper interpretation of this indicator difficult [65]. Thus, more consensus around this issue is needed before this indicator can be recommended for routine use. Another negative of this indicator is the inclusion of one gender only.

Increasing numbers of countries are creating national registers of vaccinations that can easily be used to create quality indicators for preventive health care. The patterns for indicators based on vaccinations are easy to interpret, and their high frequency produces robust estimates after social stratification in relatively small sample. A potential confounding factor in the validity of vaccination rates as indicators of quality of preventive health care is vaccine resistance on the part of parents, which is particularly strong in central Europe. This public resistance has led to outbreaks of measles in recent years [83]. This can be expected to interfere with the interpretation of inequity patterns, so that differences between children in low and SES families are attenuated or even reversed. This was examplifed by two German studies of vaccination uptake [108,109].

Limitations

There were only a handful of studies of utilization of health care that included measures of health care need, and accordingly most studies allowed for analysis of horizontal, but not vertical, inequity [8]. Comparing inequity patterns in large studies in national registers with comparatively small surveys can also be problematic. There tends to be an over-representation of the most marginalized in the attrition of population surveys, such as people who don't own a telephone, have no fixed address or who do not speak the language that is used in the survey [110]. This may lead to an underestimation of the true differences between low and high SES populations. Register studies, although often more representative of marginalized populations, are sometimes based on overestimations of the foreign-born population [111], which may lead to underestimations of health care use and vaccination rates in their children.

Different SES indicators were used by different countries in the data collected, family income was the main SES measure in Sweden, Denmark and Iceland, Education in Finland and the other countries using SES categories based on characteristics of small or large (Ireland) geographic areas/neigbourhoods. Both these forms of measuring SES are based on ranking high to low social position, but the correlation of them is low [112], even within the same population. Thus, comparisons of the magnitude of differences between SES categories from different countries in these quality indicators should be made with care. A similar diversity of SES indicators was also present in the literature review, making direct comparisons of social gradients challenging.

In accordance with the priorities suggested by the WHO Report on the Social Determinants of Health [10,12], much of the data in this study is more relevant for infancy and early childhood, a key period during the life course in the development of health inequities. However, this means that results cannot automatically be generalized to other ages beyond preschool age; this is particularly true for teenage children, where the only data in the study is on asthma.

As previously stated, many primary care organisations have been reformed in later years, which pose a challenge of representability for the current situation of some of the information presented in this report. This is particularly the case for the older studies in the literature review, ehere some of the data was collected in the first year of the 2000's- There is a need for continuous monitoring of the quality of primary care by different social groups to evaluate the effect of these ongoing reforms.

The material presented in this report is very limited when it comes to the situation in the new member states in Eastern Europe. Uptake of vaccinations in this part of Europe is traditionally very high, which makes it likely that children in low SES families also have a high uptake of vaccinations. The low vaccination rates among the Roma that was found in several studies, and the considerable number of unregistered Roma children found in Poland, however, do suggest that the inequity perspective is a relevant issue also in this part of Europe [113]. The considerable variation in vaccination rates between the different countries in Eastern Europe suggests that there are important examples of successful interventions in some countries that need to be shared. Apart from vaccinations, there were no studies on health care utilization care in a socio-economic perspective in Eastern Europe, and thus there is a great need of such studies to inform efforts to improve primary care for children.

Conclusions and Implications

This report has described diverse patterns of equity in different European primary care models for children. There appears to be more inequity in access to primary care for children in socially disadvantaged families in the population in primary care models where professionals have greater freedom when it comes to the location of their practice. This finding is also pertinent for countries that have national health services with traditionally strong government control over the health system, because ongoing reform in these countries is loosening up the control over the location of general practices with increasing inequity as a possible consequence.

The report also points to the importance of looking at the organisation of curative and preventive health services separately, since they often have separate organisations in primary care models for children. Preventive health care for school children is often provided within school health services, in addition at least six countries provide preventive health services for preschool children in special units within primary care, "well baby clinics". Countries that have "well-baby clinics" were reported to have quite equitable delivery of vaccinations and other indicators of preventive health services. However, a similar level of equity was also shown for some countries with a more integrated approach to preventive health services. There is a need for further studies of quality of the diverse models for preventive health for children in Europe to clarify the best way of designing these services.

This report pioneered the use of quality indicators based on administrative data for cross-country comparisons of quality in primary care for children. Uptake of vaccinations was found to be a meaningful indicator in such comparisons, while age at diagnosis of autism was found to be a difficult indicator to access in administrative data. Age at operation for cryptorchidism was more accessible, but lack of consensus with regards to acquired cryptorchidism challenges the validity of this indicator. Ambulatory-care sensitive conditions are problematic in comparisons between countries, because of structural factors that influence incidence rates of hospital admissions. Further studies, with longitudinal data from primary as well as hospital care, are needed to validate ambulatory-care sensitive conditions for children as quality indicators of primary care for children in Europe.

An important finding in this report is the dearth of information for evaluation of equity in primary care for children in Europe. This was particularly true for the newer EU member states in Eastern Europe. It was also shown that evaluations of primary care for adults cannot automatically be extrapolated to primary care for children. Thus, more evaluative research with a focus on children is needed to inform primary care models for children with regards to equity. Such research should ideally use standardized

measures of SES, indicators of health care needs to allow for evaluation of vertical equity and evidence based measures of quality of primary care for children, such as the child edition of the Primary Care Assessment Tool (PCAT).

Acknowledgements

The work with this report has been supported by a number of devoted child health professionals and researchers outside of the MOCHA project. We are indebted to the support of Luis Rajmil, IMIM, Barcelona, Spain in all phases of the production of the report, and also for providing the Catalonian vaccination data. David Taylor-Robinson, University of Liverpool and Nick Spencer, University of Warwick provided valuable comments on a first draft of this report. Astrid Guttman, Institute for Clinical Evaluative Sciences, Toronto and Sharon Goldfeld, Murdoch Childrens Research Institute, Melbourne provided valuable advice in the use of ambulatory care sensitive conditions. Ruth Gilbert, Mathew Jay, Linda Wiljars, Pia Hardelid and Kate Lewis at the Institute of Child Health, UCL, London provided valuable advice in the analysis of the administrative data and also provided the English quality indicators based on hospital data. Abdulfatah Adam and Anne-Marie Nybo-Andersen, Department of Social Medicine, University of Copenhagen provided the Danish hospital based quality indicators, and Marie Nörredam and Laura Deen Christensen, MESU, University of Copenhagen the Danish vaccination data. Declan McKeown, HSE Health Intelligence Unit and Anthony Staines, University of Dublin, providided the Irish quality indicators. Thomas Wallby, Uppsala university, provided the Swedish vaccination data.

Within the MOCHA project we are indebted to Mika Gissler, Reli Mechtler to Geir Gunnlaugsson for valuable comments and provision of data, Simon de Lusignan and Ana Correa for providing the vaccination data for England, to Paul Kocken for valuable comments and to Denise Alexander for editing and language advice. For the information in Table 3 about preventive health services the country agents in MOCHA were essential http://www.childhealthservicemodels.eu/partnerlisting/country-agents/ .

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Appendix 1.

Search terms for Systematic Review (MOCHA) of Healthcare Uptake

EMBASE_Final Search_161113

'health care access'/exp OR 'health care disparity'/exp OR 'health care utilization'/exp OR ('health care' OR healthcare OR 'medical care') NEAR/3 (disparity OR disparities OR equity OR inequity OR equities OR inequities OR access OR accessibility OR utili?ation OR usage OR uptake)

AND

'child health care'/exp OR 'child'/exp OR 'infant'/exp OR 'adolescent'/exp OR 'child health care' OR 'child healthcare' OR child OR children OR infant OR infants OR adolescent*

AND

'social status'/exp OR 'socioeconomics'/exp OR 'social class'/exp OR 'ethnicity'/exp OR 'migrant'/exp OR 'social status' OR 'social class' OR socioeconomic OR 'socio economic' OR 'socio-economic' OR 'socio-demographic' OR 'sociodemographic' OR 'socio demographic' OR 'social disadvantage' OR 'household income' OR ethnic* OR immigrant* OR migrant* OR refugee* OR 'asylum seek*' OR 'lone parenthood' OR 'single mother*' OR 'single parent*' OR 'social disparit*' OR inequity OR inequities OR 'socially disadvantaged' OR 'social inequalities' OR 'social inequality'
[2000-2016]/py

PUBMED_Final Search_161113

Health equity[MeSH Terms]) OR healthcare disparities[MeSH Terms]) OR health equity[Title/Abstract]) OR "HealthCare inequities"[Title/Abstract]) OR “Health Care inequities”[Title/Abstract]) OR “Health Care inequalities”[Title/Abstract]) OR “Healthcare inequalities”[Title/Abstract]) OR “Health Care inequality”[Title/Abstract]) OR “Healthcare inequality”[Title/Abstract]) OR "Healthcare disparities" [Title/Abstract]) OR "Healthcare disparity"[Title/Abstract]) OR "Health care disparities"[Title/Abstract]) OR "Health care disparity"[Title/Abstract]) OR “Access to Health Care" [Title/Abstract]) OR “Access to Healthcare" [Title/Abstract]) OR "Accessibility of Health Services" [Title/Abstract]) OR Healthcare access*[Title/Abstract]) OR Health care access*[Title/Abstract]) OR “health care utilization"[Title/Abstract] OR “health care uptake"[Title/Abstract] OR “healthcare uptake"[Title/Abstract] OR “healthcare utilization"[Title/Abstract] OR “healthcare utilisation"[Title/Abstract] OR “health care utilisation"[Title/Abstract] OR “medical care utilization” [Title/Abstract] OR “medical care utilisation”[Title/Abstract] OR “health care use"[Title/Abstract] OR

“healthcare use"[Title/Abstract] OR “medical care use” [Title/Abstract] OR “use of healthcare” [Title/Abstract] OR “use of health care” [Title/Abstract] OR “utilization of health services” [Title/Abstract] OR “utilisation of health services” [Title/Abstract] OR “ access to health services” [Title/Abstract]))

AND

((((((((((child[MeSH Terms]) OR minors[MeSH Terms]) OR adolescent[MeSH Terms]) OR child health services[MeSH Terms]) OR infant[MeSH Terms]) OR child[Title/Abstract]) OR children[Title/Abstract]) OR adolescents[Title/Abstract]) OR adolescent[Title/Abstract]) OR infant[Title/Abstract]) OR infants[Title/Abstract])

AND

((((((((((((((((((((((((socioeconomic factors[MeSH Terms]) OR (transients and migrants[MeSH Terms])) OR "social class"[Title/Abstract]) OR "social status"[Title/Abstract]) OR "socioeconomic factors"[Title/Abstract]) OR ethnic*[Title/Abstract]) OR socioeconomic[Title/Abstract]) OR "socio economic"[Title/Abstract]) OR "socio-economic"[Title/Abstract]) OR "socio-demographic "[Title/Abstract]) OR "sociodemographic"[Title/Abstract]) OR "socio demographic"[Title/Abstract]) OR social disadvantage*[Title/Abstract]) OR "household income"[Title/Abstract]) OR immigrant*[Title/Abstract]) OR migrant*[Title/Abstract]) OR refugee*[Title/Abstract]) OR asylum seek*[Title/Abstract]) OR "lone parenthood"[Title/Abstract]) OR "single mother"[Title/Abstract]) OR "single parent"[Title/Abstract]) OR social disparit*[Title/Abstract] OR inequity [Title/Abstract] OR inequities [Title/Abstract]) OR "Socially disadvantaged"[Title/Abstract] OR "social inequalities" [Title/Abstract])OR "social inequality" [Title/Abstract])))))

AND ("2000/01/01"[Date - Publication] : "3000"[Date - Publication])

Web of SCIENCE_Final Search

((healthcare OR "health care" OR "medical care" OR "health services") NEAR/3 (disparity OR disparities OR equity OR inequity OR equities OR inequities OR access OR accessibility OR utilization OR utilisation OR use OR usage OR uptake))

AND

“child health care” OR “child healthcare” OR "child health services" OR child OR children OR infant OR infants OR adolescent*

AND

“social status” OR “social class” OR socioeconomic OR "socio economic" OR "socio-economic" OR "socio-demographic " OR "sociodemographic" OR "socio demographic" OR “social disadvantage” OR "household income" OR ethnic* OR immigrant* OR migrant* OR refugee* OR “asylum seek*” OR

"lone parenthood" OR "single mother*" OR "single parent*" OR “social disparit*” OR inequity OR inequities OR "Socially disadvantaged" OR "social inequalities" OR "social inequality"
AND ("2000/01/01"[Date - Publication] : "3000"[Date - Publication])

Search terms for Systematic Review of Vaccinations

July 27, 2017

EMBASE

'vaccination'/exp OR vaccination OR vaccine* OR immunization OR immunisation OR vaccinated OR immunized OR immunised
AND
'child health care'/exp OR 'child'/exp OR 'infant'/exp OR 'adolescent'/exp OR child* OR infant* OR adolescent*
AND
'social status'/exp OR 'socioeconomics'/exp OR 'social class'/exp OR 'ethnicity'/exp OR 'migrant'/exp OR 'social status' OR 'social class' OR socioeconomic OR 'socio economic' OR 'socio-economic' OR 'socio-demographic' OR 'sociodemographic' OR 'socio demographic' OR 'social disadvantage' OR 'household income' OR ethnic* OR immigrant* OR migrant* OR refugee* OR 'asylum seek*' OR 'lone parenthood' OR 'single mother*' OR 'single parent*' OR 'social disparit*' OR inequity OR inequities OR 'socially disadvantaged' OR 'social inequalities' OR 'social inequality'
AND
[2000-2017]/py

PUBMED

(((((((Vaccination [MeSH Terms]) OR “vaccination” [Title/Abstract]) OR “vaccine” [Title/Abstract]) OR “vaccines” [Title/Abstract]) OR immunisation [Title/Abstract]) OR immunization [Title/Abstract]) OR “vaccinated” [Title/Abstract]) OR “immunized” [Title/Abstract]) OR “immunised” [Title/Abstract])
AND
((((((((((child[MeSH Terms]) OR minors[MeSH Terms]) OR adolescent[MeSH Terms]) OR child health services[MeSH Terms]) OR infant[MeSH Terms]) OR child[Title/Abstract]) OR children[Title/Abstract]) OR adolescents[Title/Abstract]) OR adolescent[Title/Abstract]) OR infant[Title/Abstract]) OR infants[Title/Abstract])
AND
(((((socioeconomic factors[MeSH Terms]) OR (transients and migrants[MeSH Terms])) OR "social class"[Title/Abstract]) OR "social status"[Title/Abstract]) OR "socioeconomic factors"[Title/Abstract]) OR ethnic*[Title/Abstract]) OR socioeconomic[Title/Abstract]) OR "socio economic"[Title/Abstract]) OR "socio-economic"[Title/Abstract]) OR "socio-demographic "[Title/Abstract]) OR

"sociodemographic"[Title/Abstract]) OR "socio demographic"[Title/Abstract]) OR social disadvantage*[Title/Abstract]) OR "household income"[Title/Abstract]) OR immigrant*[Title/Abstract]) OR migrant*[Title/Abstract]) OR refugee*[Title/Abstract]) OR asylum seek*[Title/Abstract]) OR "lone parenthood"[Title/Abstract]) OR "single mother"[Title/Abstract]) OR "single parent"[Title/Abstract]) OR social disparit*[Title/Abstract] OR inequity [Title/Abstract] OR inequities [Title/Abstract]) OR "Socially disadvantaged"[Title/Abstract] OR "social inequalities" [Title/Abstract])OR "social inequality" [Title/Abstract])))))

AND ("2000/01/01"[Date - Publication] : "3000"[Date - Publication])

Web of SCIENCE

(vaccination OR vaccine* OR immunization OR immunisation OR vaccinated OR immunized OR immunised)

AND

(“child health care” OR “child healthcare” OR "child health services" OR child OR children OR infant OR infants OR adolescent*)

AND

(“social status” OR “social class” OR socioeconomic OR "socio economic" OR "socio-economic" OR socio-demographic OR "sociodemographic" OR “social disadvantage” OR "household income" OR ethnic* OR immigrant* OR migrant* OR refugee* OR “asylum seek*” OR "lone parenthood" OR "single mother*" OR "single parent*" OR “social disparit*” OR inequity OR inequities OR "Socially disadvantaged" OR "Social disadvantage" OR "social inequalities" OR "social inequality" OR disparit*)

AND ("2000/01/01"[Date - Publication] : "3000"[Date - Publication])

Appendix 2. Instructions for reporting of quality indicators.

General:

- Excel –tables have been constructed to facilitate the reporting by year. If you report several years, just copy the Excel sheet.

- For all indicators take the most recent year available. If possible, take the last five years, reported year by year.

- Regional data is OK, national data of course better. 2 regions better than one…

- All indicators should be linked to some kind of SES indicator, either of the family or the neigbourhood/small area or both.

- Gender is also an essential stratification.

- If you have a regional indicator of rural/urban you can stratify by, that's also very useful, but this is not an essential stratification.

- Stratification by single parent households is useful, but optional.

- Stratification by ethnicity/migrant status is useful, but optional. Use the categorization commonly used in health statistics in your country/region.

- This indicator should, if possible, be constructed as quintiles in the population in the study

Definitions of quality indicators.

1. Measles vaccination. At least one vaccination of a measles containing vaccine <2 years of age. (indicator of access to prevention) in native born children.

2. Operation for Cryptorchidism:

    a. Mean and median age at operation for cryptorchidism in the range 0-17.99 years, with one decimal.

    b. % operated <3.0 years and 3.0-17.99 years. (indicator of screening quality) in native born children. Excludes children with other genital malformations (se coding below).

    c. % operated <1.0 years. (age of recommended operation in many countries) in native born children. Excludes children with other genital malformations (se coding below).

3. Yearly incidence of gastroenteritis admissions in native-born 1-5 year olds. If available, also ER visits and/or primary care visits (optional). (indicator of acute care).

4. Yearly incidence of Asthma admissions in 6-15 year olds. If available also yearly incidence of ER visits, primary care visits and deaths (optional). (indicator of care for chronic disorders).

5. Age at first diagnosis of Autism spectrum disorder in native born children. (indicator of detection of developmental disabilities). Each of the three concepts of autism defined below should be analysed separatel-.

Addendum:

2. ICD-codes all beginning with 'Q53', and also 'Q550', 'Q551'. Operation codes in observations with these diagnoses in Nordic classification;
KFH10=’Simple orchidopexy’

    KFH00= ‘Radical operation for cryptorchidism’

    JAH01=’Laparascopy’

3. All beginning with A08 or A09, excluding those who have a complimentary diagnosis of A04, A05, A06, A07 or K529.
4. All beginning with J45 and J46, excluding those who have or have had a complimentary diagnosis of 'E84', 'J984', 'P27', 'P28', 'Q30','Q31', 'Q32', 'Q33', 'Q339', Q34, 'Q391', 'Q392', 'Q254' ,
5. ICD-10 codes of ASD= childhood autism (F84.0), Asperger's syndrome (F84.5) and other pervasive developmental disorder including PDD-NOS (F84.8 and F84.9)